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PREVENTION OF INFANT MORTALITY BY BREAST FEEDING

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Much has been said from time to time in favor of breast feeding of infants; and statements have been made that 80 or 85 per cent. of infant deaths occur among bottle-fed babies.

But such statements have lacked force because it has not been apparent how many mothers nurse their babies and how many bring them up on the bottle.

If 80 per cent. of infant deaths occur among bottle-fed babies, and if it should be found that 80 per cent. of all babies are bottle fed, then there would be no case at all against bottle feeding.

In order to find out the percentage of babies that are bottle fed, the Boston Board of Health recently sent about 900 letters to mothers who had births recorded within the past year. Care was taken to select proportionate numbers of babies of various age periods, namely, two weeks to one month, one to three months, three to six months, six to nine months, and nine to twelve months, and to select proportionate numbers of babies from the various wards and from the various mother nativities—the number of births in 1910 in the various wards of various mother nativities being taken as the basis for these proportions. Aside from obtaining the proportionate numbers of babies in the way just indicated, care was taken not to select these babies in any way but to take them at random from the birth returns furnished by the Registry Department. The circular sent to each mother was as follows:

"*Dear Madam*:—To assist the Board of Health in its campaign to save the babies of Boston, will you please answer the following questions regarding your child and return this slip at once in the enclosed envelope.

"Is this child breast fed? (Answer yes or no.)

"How long was it breast fed?

"Is this child bottle fed? (Answer yes or no.)

"How long has it been bottle fed?

"If bottle fed, what food has been used?"

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Replies were received promptly from over half of the mothers addressed, and an additional 200 replies were obtained through the Board of Health nurses, who went to the homes for the information.

Table I gives the results of this investigation—the number of replies received for babies of various ages and mother nativities and the percentages of breast and bottle fed babies.

TABLE I.

LIVING BABIES—BREAST OR BOTTLE FED.

TOTAL REPLIES.

Mother Nativity.	2 weeks to 1 year	2 weeks to 1 year		2 weeks to 1 month.		1 to 3 months		3 to 6 months		6 to 9 months		9 to 12 months		Percentage breast fed
		Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	
United States.	272	174	98	44	8	33	23	42	19	24	29	31	19	64
Ireland.	120	93	27	17	1	24	6	23	8	16	5	13	7	77
England, Scotland and Wales.	20	15	5	1		3	1	4	1	3	2	4	1	——
Germany.	2	1	1					1	1					——
Canada.	69	38	31	5	1	8	7	8	9	8	8	9	6	55
Scandinavia.	10	8	2	1		1	1	2		3	1	1		——
Italy.	123	106	17	24	2	23	4	23	2	18	2	18	7	86
Russia and Poland	120	98	22	20	2	21	7	21	6	17	6	19	1	82
Totals.	736	533	203	112	14	113	49	124	46	89	53	95	41	72
Percentages.		72	28	89	11	70	30	73	27	63	37	70	30	

The number of replies was 736, of which 533, or 72.4 per cent., were breast fed and 203, or 27.6 per cent., were bottle fed. But the information thus obtained is only for living children. To determine what proportion of all babies are bottle or breast fed, it is necessary to add a proportionate number of the deaths of 1911. These necessary additions are given in Table II. Adding the figures in each square of Table II to the figures in the corresponding square of Table I, totals may be obtained which show the relative proportions of breast and bottle-fed babies in Boston. The corrected percentages shown in Table II were thus obtained. At various places in the table there appear higher percentages of breast feeding for the older babies than for the younger. This, of course, is an error due to too few replies and would be rectified if answers from all the mothers of 1911 could be tabulated. But the evidence furnished by these 736 replies is very striking and may be used for present calculations.

TABLE II.

DEATH ADDITIONS TO TABLE I NECESSARY TO OBTAIN CORRECTED PERCENTAGES OF BREAST AND BOTTLE-FED BABIES.

Mother Nativity.	2 weeks to 1 year.		2 weeks to 1 month		1 to 3 months		3 to 6 months		6 to 9 months		9 to 12 months	
	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle
United States.	5	27	1	3	1	9	1	7	1	4	1	4
Ireland.	3	9		1	1	2	1	2		2	1	2
England, Scotland and Wales	1	1					1	1				
Canada.	2	7		1	1	2	1	2		2		
Scandinavia.		1				1						
Italy.	6	6	1	1	1	1	1	1	2	2	1	1
Russia and Poland.	3	5	1		1	1		2	1	1		1
Totals.	20	56	3	6	5	16	5	15	4	11	3	8

CORRECTED PERCENTAGES FOR THE VARIOUS AGE PERIODS.

	2 weeks to 1 year		2 weeks to 1 month		1 to 3 months		3 to 6 months		6 to 9 months		9 to 12 months	
	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle
Percentage.	68	32	85	15	64	36	68	32	59	41	67	33

CORRECTED PERCENTAGES OF BREAST-FED INFANTS OF VARIOUS MOTHER NATIVITIES.

Children of mothers born in the United States,	59
" " " " Ireland,	73
" " " " Canada,	51
" " " " Italy,	83
" " " " Russia and Poland,	79

Italy leads, with 83 per cent. breast fed; Russia and Poland come next, with 79 per cent. breast fed; Ireland and the United States follow, with 73 per cent. and 59 per cent., respectively; while Canada makes the poorest showing, with only 51 per cent. breast fed. The replies from mothers born in England, Scotland and Wales, Germany and Scandinavia, were too few to warrant any estimate for the babies of these mother nativities.

Table III gives for 1911 the total mortality of infants by age, by mother nativity and by feeding (for infants over two weeks of age).

Table IV gives for 1911 the total mortality of infants by month, by age and by feeding (for infants over two weeks of age).

TABLE III.

1911 MORTALITY OF INFANTS BY AGE, BY MOTHER NATIVITY AND BY FEEDING (FOR INFANTS OVER TWO WEEKS OF AGE.)

	TOTAL DEATHS													Per cent. of deaths 2 weeks to 1 year breast fed
Mother nativity.	Total deaths under 1 year	2 weeks to 1 year.		2 weeks to 1 month		1 to 3 months		3 to 6 months		6 to 9 months		9 to 12 months		
		Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	
United States,	927	106	544	26	58	20	172	31	144	15	93	14	77	16
Ireland,	345	48	179	7	20	16	47	8	53	8	29	9	30	21
England, Scotland and Wales,	61	13	25	1	2	4	6	5	10	1	4	2	3	34
Germany,	12	3	6	1			2		1	1		1	3	33
Canada,	232	32	128	5	10	7	40	7	33	7	35	6	10	20
Scandinavia,	30	5	15		3	2	4	3	4		3		1	25
Italy,	292	124	112	13	13	26	21	21	27	37	32	27	19	53
Russia and Poland,	230	60	101	11	8	17	21	11	29	13	23	8	20	37
Other countries,	87	21	51		1	6	12	5	10	6	18	4	10	29
Unknown,	29	1	25		1		13	1	3		3		5	4
Totals,	2,245	413	1,186	64	116	98	338	92	314	88	240	71	178	26
Percentages,		26	74	36	64	22	78	23	77	27	73	29	71	

Note: There were four deaths over two weeks where method of feeding was not known.

TABLE IV.

1911 MORTALITY OF INFANTS BY MONTH, BY AGE AND BY FEEDING (FOR INFANTS OVER TWO WEEKS OF AGE.)

	TOTAL DEATHS.												
Month	Total Deaths under 1 year	2 weeks to 1 year		2 weeks to 1 month		1 to 3 months		3 to 6 months		6 to 9 months		9 to 12 months	
		Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle	Breast	Bottle
January,	162	34	64	7	6	10	21	8	20	5	9	4	8
February,	175	49	65	8	5	13	17	7	16	13	13	8	14
March,	196	41	101	10	8	11	35	7	22	9	27	4	9
April,	191	38	102	8	10	9	28	10	23	7	22	4	19
May,	181	34	85	7	15	4	22	11	20	5	13	7	15
June,	129	21	61	4	8	6	19	3	10	6	14	2	10
July,	280	39	184	3	10	8	46	10	46	10	49	8	33
August,	260	40	181	5	14	6	40	12	64	8	38	9	25
September,	224	40	137	2	16	7	39	10	39	10	23	11	20
October,	172	26	86	1	5	9	27	6	28	3	13	7	13
November,	138	24	62	3	9	9	24	3	12	5	10	4	7
December,	137	27	58	6	10	6	20	5	14	7	9	3	5
Totals,	2,245	413	1,186	64	116	98	338	92	314	88	240	71	178

Notice in Table IV that there is only a slight increase of deaths among breast-fed babies during the summer months. July, August and September, with 39 and 40 such deaths each month, are lower than February, March and

April with 49, 41 and 38 deaths, respectively. The number of deaths among bottle-fed babies, however, jumps up tremendously in July, August and September.

Table III shows that only 26 per cent. of infant deaths between the ages of two weeks and one year occur among breast-fed babies. And of infants over two weeks old, born of native mothers, only 16 per cent. of the deaths occur among breast-fed children; while of babies over two weeks of Italian mothers, 53 per cent. of the deaths occur among breast-fed children.

Bottle-fed babies between the ages of one and three months show the highest mortality, especially those babies having mothers born in the United States.

Interesting and instructive as the foregoing figures and rates may be, ten times more interesting and instructive are the estimates which can be obtained from those tables. Many such estimates are tabulated in Table V.

If 74 per cent. of infant deaths above the age of two weeks are among bottle-fed babies and only 32 per cent. of babies over two weeks are bottle fed, then the bottle-fed infant over two weeks old is six times as likely to die as the breast-fed infant.

Again, if all the infants above the age of two weeks had been breast fed, or equally well fed (for it is by no means proven that bottle feeding may not be so safeguarded that the mortality will be no greater than among breast-fed babies), there would have been only 1,253 infant deaths last year, while if all had been bottle fed there would have been 4,352 such deaths.

The actual number of infant deaths last year was 2,245, which gives a rate of 127 per thousand births.

Breast feeding of all babies would have saved nearly a thousand lives last year, and the death rate per 1,000 births would have been 71 instead of 127.

TABLE V.

ACTUAL DEATH-RATES AND ESTIMATED DEATH-RATES IF ALL CHILDREN HAD BEEN BREAST FED.

	MOTHER NATIVITY					
	United States	Ireland	Canada	Italy	Russia and Poland	Totals for Boston
Births, 1910.	6,226	2,816	1,747	2,703	2,479	17,668
Deaths under one year, 1911.	927	345	232	292	230	2,245
Rate per 1,000 births (using the 1910 births).	149	123	133	108	93	127
Percentage of children between two weeks and one year, breast fed (estimated).	59	73	51	83	79	68
Deaths, 1911, of children between two weeks and one year.	653	227	160	236	162	1,603
Percentage of deaths between two weeks and one year, breast fed.	16	21	20	53	37	26
Estimated total infant deaths, 1911, if all above age of two weeks, had been breast fed.	457	184	135	205	145	1,253
Lives saved if all above age of two weeks had been breast fed.	470	161	97	87	85	992
Estimated death-rate if all above two weeks had been breast fed.	73	65	77	76	58	71
Estimated reduction in death-rate if all above two weeks had been breast fed.	76	58	56	32	35	56

There would have been 470 less deaths among the children of native mothers; 161 less deaths among the children of Irish mothers; 97 less deaths among the children of Canadian mothers; 87 less deaths among the children of Italian mothers; and 85 less deaths among the children having mothers born in Russia and Poland.

A large part of this saving of infant life is to be expected in the great reduction of deaths from diarrhea and enteritis. Of 621 deaths from diarrhea

and enteritis last year between the ages of two weeks and one year, 87 were breast fed and 534 bottle fed; i. e., 86 per cent. were bottle fed. If all the babies had been breast fed the estimated number of these deaths would have been 493 less than actually occurred.

These figures are so startling that I feel that this investigation ought to be continued till 5,000 or 10,000 replies have been received from mothers, so that no opportunity be given to criticise the figures on the score of paucity of data.

These estimated rates measure the possible reduction in infant mortality if all babies could be breast fed, and they also show in what nationalities most of the improvement is to be expected.

Such a saving of infant life is not a mere fancy. The reduction of the infant mortality rate from 127 to 71 is entirely within the range of possibilities.

New Zealand in 1909 had a rate of 62 and South Australia for the same year had a rate of 61.

Discussion.

Dr. CHAPIN. It is a great pleasure to have a paper like this presented here showing such interesting facts in such a clear and impressive way. We have had data of this kind from Berlin, London and other places, but to have them from a place right here will better carry conviction to the public. We all realize, I think, from these figures, as we have to some extent before, the great advantage of breast feeding. How to secure more breast feeding has been the great problem. In conversation with nurses in Providence it has developed that it is their opinion that a good deal of bottle feeding is due to the fact that the mothers do not know how to conserve the breast milk. We have, in order to assist mothers in this respect, prepared a circular explaining the best way of securing a good secretion of breast milk and maintaining it, and that circular has been used very largely by the nurses in instructing the mothers. But it is certainly a great help to us to have home figures with which to back up our arguments.

THE CHEMICAL DISINFECTION OF SEWAGE

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Before an association of public health officials it will be unnecessary for me to dwell at any length upon the eminent desirability of some kind of sewage disinfection. Sewage, representing as it does, the wastes of modern community life, is the very embodiment of the idea of uncleanness and of unwholesomeness. It may contain at any time highly infectious material, and probably does at all times carry germs capable of setting up abnormal processes in human beings. In earliest historical times these facts were recognized and provision for the proper disposal of excrement was accordingly made. Some time after the advent of sewers, the real problem of sewage disposal made itself felt, and early attempts at sewage purification were made with the primary idea of destroying in the sewage its power to communicate disease—that is, to disinfect it.

One of the most successful of these attempts was the sand filter, a device which needs no introduction before a Massachusetts audience. This state is the home of the sand filter, and through the activities of the State Board of Health, extending back over the past twenty-four years or more, it has been brought to its present high degree of efficiency. The sand filter did its work well and could be relied upon to remove a very large percentage of the sewage bacteria. In addition to this it purified the sewage so thoroughly that in appearance, in taste, and in all other ways by which one ordinarily judges, a pure drinking water resulted.

Unfortunately the use of this excellent device is limited to those smaller communities which are situated near natural sand areas. Cities of the Middle West and of many other parts of this country have for the most part no such good fortune as is ours in Massachusetts. Even here the necessary land cannot always be found, and it is becoming more and more difficult each year to find suitable sand areas in the neighborhood of the cities. Where, for example, could Boston find the thousand or more acres of sandy soil which would be required for the treatment of the sewage of the city proper? The limitations of this process have led investigators in many countries to seek improved methods of purification requiring smaller areas of land. Particularly in England has this been the case, and there have resulted two processes known respectively as the contact bed and the trickling filter. It will be unnecessary to go into the details of these processes at this time further than to state that a modern trickling filter treats sewage at a rate twenty or more times as great as the permissible rate of the old sand filter. The results, however, are far less perfect, and especially in the matter of removal of bacteria these rapid filters leave much to be desired. Sewage purification in fact and especially up to a few years ago, had come to be looked upon as a means of depriving sewage of its offensive characteristics, of its tendency to putrefy, but not of its bacteria. This is a somewhat debatable point and there may be some exception taken to such a state-

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ment, but it is the writer's belief, founded upon somewhat extensive observation and experiment, that a fifty or sixty per cent. removal of bacteria is about all that can be obtained in actual practice by a trickling filter, working under practical conditions upon the sewage of a city.

This half-way measure, judged from a bacterial standpoint, has been forced upon us by the necessities of the situation, and, were it not for the possibilities of chemical disinfection, the purification of sewage by the only practical means available for our larger communities would not constitute a material improvement in stream conditions, viewed solely now from a bacterial and sanitary standpoint.

A further and still more important reason, however, for taking up the study of chemical disinfection, results from the common practice of discharging sewage into rivers or other bodies of water without treatment. However, as sanitarians, we may deprecate such practices, and however earnestly we may labor to make better conditions possible and, in consequence, enforcible, the fact remains that biological sewage purification with all the advances of the past decade is still beyond the reach of most large cities. The reason for this is not so much the expense involved as the great difficulty in securing proper locations for disposal works. It happens, fortunately, that the large centers of population are generally located upon large rivers or upon the seaboard, where there is water enough to dilute the sewage so that no obvious physical nuisance results. There remains, then, only the danger incident to the discharge of disease germs, with a possibility that these germs may reach public water supplies, shell-fish areas, or bathing beaches, or otherwise become a source of infection.

The Merrimac River will serve as an excellent illustration. The sewage of Lowell, the largest city on the river, is discharged without any attempt at purification into the water supply of Lawrence, the next largest city, and Lawrence and the cities below, in their turn, discharge their untreated sewage into the same stream. At the mouth of this river is located one of the largest and most productive soft clam areas of the state, an area from which clams are taken throughout the year for shipment to many parts of this country.

The physical capacity of the waters of this river to receive and dispose of sewage without nuisance, although utilized to about its natural limit, has thus far proven sufficient or nearly sufficient for the burden thrown upon it. Fortunately, also, Lawrence filters this water before drinking it. But the margin here is too narrow. Instances are not lacking in this and similar cases where deaths have resulted from a failure of the water filter to properly perform its task. Moreover, no similar safeguard can be thrown about the shell-fish industry. A recent study of the situation, undertaken on behalf of certain Boston wholesale dealers, convinced the writer that clams from these areas were probably unsuited for human consumption, and could not be used by these dealers in their interstate business without incurring the danger of federal seizure and prosecution, in which event no successful defense could be maintained.

This example is merely cited as an illustration of the desirability of sewage purification in general, and of disinfection or the destruction of germs in partic-

ular; and the whole subject of the desirability of disinfection has been considered rather extensively because, with our present simple methods of procedure, it is more difficult to determine when disinfection is called for than it is to say how it may be accomplished.

Turning now to the methods of disinfection, one finds a history that is varied and interesting. Long before the general acceptance of the germ theory of disease, chemical methods of sewage purification were recommended and used. Deodorization and the prevention of offensive putrefaction, believed at that time to be disease producing, were the purposes chiefly in view.

Later, in 1889, the Webster electrolytic process was proposed, primarily as a means of clarifying sewage. It was pointed out incidentally, however, that a great reduction of bacteria took place. After this came many electrolytic processes in which either the sewage itself was electrolyzed between plates of iron, or sea water was thus treated and later added to the sewage. In Germany, the use of hypochlorites was proposed as an emergency measure at times of epidemics, but German experiments, as well as those made later by Rideal at Guilford, England, indicated excessive costs, a feature which has always been a barrier to the introduction of chemical disinfection methods.

This was the condition of affairs when investigations were begun at the Institute of Technology Experiment Station, in the Spring of 1896. Recognition of a rather curious fact in bacteriology contributed to the final successful outcome. It was known to bacteriologists that in any process of killing bacteria, whether it be by heat, cold, chemical action, or other unfavorable conditions, the bacteria do not all die at once. They behave much as soldiers would if exposed in a body to a disastrous artillery fire. The mortality at first is great. Then it becomes less and less as the number of living decreases. The percentage mortality is as great up to the end if the marksmanship is equally good, but the actual death rate becomes smaller. Obviously now, if the enemy wished to conserve his powder and lead there would come a time when it would not pay to continue the firing for the sake of bringing down the few survivors. Chemical disinfection is exactly parallel. To kill all the bacteria requires very strong doses of disinfectant and long time of contact. To kill 99% of them might require half as much or one-third as much and corresponding shorter time. The practical question before us was, therefore, not how much disinfectant is required to kill *all* the bacteria, but how great a result can be achieved by the use of quantities which we can afford to employ. Perfection, however desirable, is hard to attain. How nearly can we reach it without making the process so costly that it will be impracticable?

Several disinfectants suggested themselves for trial and a thorough review of the whole subject was undertaken. The details of this investigation have all been published elsewhere, and it will be unnecessary to burden these pages with them. Suffice it to say, that the question came down to two classes of disinfectants—copper compounds and chlorine compounds. The one, a poisonous metal, acts like mercury and other heavy metals; the other, an oxidizing agent, is the active constituent of ordinary chloride of lime or bleaching powder. Of these

two, the chlorine compounds proved themselves by far the more efficient, and of the several forms of chlorine, ordinary chloride of lime—more properly hypochlorite of calcium—produces better results for the money than any other.

The amount necessary varies greatly with the character of the sewage or effluent. The stronger the sewage, the greater the amount required. Crude Boston sewage requires on the average about five parts per million of available chlorine, or 125 pounds of bleaching powder per million gallons for a bacterial reduction of 99%. Twice this amount gives a reduction of 99.9%, which illustrates the mortality law described, or the increasing difficulty of killing the few remaining bacteria. Filter effluents of the kind described earlier in this paper, the trickling filter effluents, require for the same degree of disinfection, two or three parts of chlorine per million; that is, 50 to 75 pounds of hypochlorite per million gallons.

Without describing the necessary engineering structure for adding and mixing the disinfectant and for storing the sewage during the short time required for the action to proceed, it is sufficient to state here that they are relatively inexpensive and require comparatively little space. The disinfectant is added in solution, at a rate which is proportioned to the flow of sewage and the sewage effluent is then passed through tanks which hold it for from half an hour to two hours, according to circumstances.

One further detail of these investigations calls for comment. These bacteria which we enumerate in routine examination are of course for the most part harmless. There are thousands of them in every drop of sewage, and the pathogens, the real agents of disease, are so comparatively rare in this motley throng, that we cannot pick them out with any degree of certainty. It might easily be argued therefore that there is no evidence thus far that the pathogens are killed at all. May they not be the one per cent. of survivors? If so, our work would be of no avail; disinfection would not disinfect. This is a hard problem to solve as is readily seen. It was attacked in this way. In all our tests, in addition to the regular enumeration of bacteria, we determined separately the numbers of the bacillus coli, the common inhabitant of the human intestine. This organism, like the others, is harmless but it gave us something to tie to. The colon bacillus was killed at about the same rate as the others; a little more completely if anything. Next we took a pure culture of this organism in water, and side by side with this a similar pure culture of the typhoid germ. These two cultures were treated with a series of varying strengths of the hypochlorite and the death rates determined under a wide range of conditions. The results were practically identical in the two cases and showed that the coli results may be accepted as safe criteria of the typhoid results.

Turning now from experiment to experience, what have been the results? Some of the original experiments were made at Baltimore for the Baltimore Sewerage Commission. At Baltimore the sewage of the great system that is now nearing completion will be purified to the highest practicable degree for the sake of the valuable oyster industry. There it was proposed to install trickling filters and follow these by sand filters. Disinfection was later substituted for the sand filters in the plans of a saving in initial cost of about a million dollars and in annual operation of over twenty-five thousand dollars. This sys-

tem is now approaching completion, and while it is thought possible that no after-treatment may be required, the simplicity of chemical disinfection makes it possible to install it at short notice, and it will be installed if it is found necessary.

In New Jersey the State Board of Health took an active interest in the process from the start and aided in the preliminary experiments at Red Bank, New Jersey. Disinfection is strongly advised by that Board and in many places where drinking-water streams or shellfish interests are at stake, insisted upon. There are at present five or six plants in operation there, others are being designed, and still others have provision made for disinfection if it should prove desirable.

The most important installation of this type, however, is at Providence, R. I., where twenty million gallons of sewage a day are being disinfected with most satisfactory results. Examinations of the oysterbeds this Fall, previous to certification by the State Commission of Shell-Fisheries, showed that many acres of beds that were condemned a year ago can now be certified under the rigid standards of that Commission and that the dead line for oysters has moved a long way up the Upper Narragansett Bay, a result due without doubt to the disinfection treatment.

Lastly, an interesting and far-reaching effect has been the application of this process to water. It was stated that the purer the sewage or effluent the less hypochlorite would be required. This principle has been extended with greatest success to the field of water purification. Veritable homeopathic doses are sufficient in this case and several hundred American cities, including the two chief cities of Canada, are now regularly using disinfected water. As an emergency means for rapidly controlling typhoid fever epidemics it has on many occasions proved of greatest value. We have at the Institute an emergency outfit by means of which, within twenty-four hours, any small water supply can be properly disinfected and all danger from typhoid fever eliminated as far as the water supply is concerned.

Chemical disinfection of both water and sewage has thus justified itself both experimentally and practically. It was said two years ago by an eminent and disinterested authority that a new epoch had been begun in both these fields. Subsequent developments have proved the correctness of this prophecy. It is now possible to raise a new and exceedingly effective barrier between the wastes of one community and the food and water supplies of another. The adequacy of this barrier is proven. Its usefulness depends upon the extent to which it shall be employed and this in turn rests with those who are officially charged with the protection of the public health.

If, by the results of these investigations, which have been but briefly recounted here, the use of our streams for carrying off the unpurified filth of cities, is made a little more reprehensible because a little less excusable, then the time, the money, and the effort that they have entailed will not have been spent in vain.

Sanitary Research Laboratory, Mass. Inst. Tech., Boston, Mass. Submitted for Publication, Feb. 1, 1912. (Discussion of this paper will be found on page 81.)

THE SANITARY REGULATION OF THE OYSTER INDUSTRY.

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There are two distinct questions involved in any attempt to regulate the sanitary quality of shellfish. First, the question of protection of the public against shellfish which are actually dangerous, that is, those which may contain disease germs and therefore may be the cause of the spread of disease; and second, the question of the protection of the public against shellfish which are merely dirty, which, in the language of the United States Pure Food ruling, consist "in whole or in part of a filthy, decomposed or putrid animal or vegetable substance," which is interpreted as meaning shellfish taken from water which contains sewage material even though this material has been so diluted or disinfected that it carries no disease-producing organisms.

I believe that we should separate these two ideas in our minds very clearly. For I am sure that we are all of the same mind in regard to the first question, but in regard to the second, we may differ in our interpretation of what is meant by "dirty." And when it comes to the enactment of laws which shall properly regulate these matters we should certainly consider the distinction between *dangerous* and *dirty*. For what is dangerous should certainly be prohibited, but where between the different degrees of dirtiness shall we draw the line showing which should be used as food and which should not?

In regard to the first of these questions, the protection of the public health, we have some accurate scientific data on which to base our opinions. Let me briefly review them.

Many shellfish, oysters in particular, are often eaten raw. These shellfish are sometimes taken from sewage-polluted waters and contain therefore the organisms which are present in sewage. These organisms may in certain cases be pathogenic. As long ago as 1880 it was suspected that shellfish might occasionally be the cause of epidemics of typhoid fever. Observations have been continued since then and now we have on record several well-authenticated cases where typhoid fever epidemics have been traced to the eating of raw polluted shellfish.

But we must consider all the facts in these cases and be perfectly fair in our conclusions. We must not condemn altogether the eating of raw shellfish, thus denying ourselves the enjoyment of a most delectable delicacy, and at the same time doing damage to a very large industry, until all the evidence is in. For as far as our knowledge goes at present no epidemics thus far studied have been due to eating shellfish *grown* in polluted waters, but in every case to eating shellfish removed from their growing beds and *"floated," "fattened"* or *"freshened"* in polluted waters. The reason for this is apparent at once. Beds on which oysters are grown are rarely situated directly at the mouths of sewers. While the presence of a little sewage in the water may hasten the growth of oysters, any considerable amount of it exhausts the oxygen, deposits a smothering mud

Read before the Massachusetts Association of Boards of Health, January 25, 1912.

upon the bottom, and makes it impossible for oysters to live. The typhoid organism is not an hardy one. It probably lives but a short time under the unfavorable conditions found in sea-water. Those that do survive are so diluted in the enormous amount of water ebbing and flowing with the tides, that few if any of them reach the oyster beds. And if a few should reach the oysters I have an idea that they would be digested and destroyed by the feeding apparatus of the oyster himself long before such oysters reach the market.

We have evidence which bears on this point in the City of Providence. The "floating" of oysters is not practiced in Rhode Island, and all oysters come directly from the growing beds. Until last winter there was nothing to prevent the use of oysters from beds in the upper part of Narragansett Bay and from the Providence River, which were badly polluted with sewage. Yet in 1910 Dr. Chapin wrote in regard to Providence: "raw oysters are very popular; they are consumed in restaurants in large numbers, and form a course in a large proportion of banquets and dinners. Many oysters are grown in the upper part of the bay in water grossly polluted with sewage and in the water and in the oysters colon bacilli are found. Yet Providence has a typhoid death-rate less than half that of the average American city. Oysters are not eaten to any extent in August when typhoid fever begins to increase and they are largely consumed in winter and spring when there is little of the disease. Very few oysters are eaten by laboring people, but at present laboring people furnish fully their share of typhoid fever."

Taking these facts altogether, then, it seems to me that there is no evidence whatever that oysters taken directly from their growing beds, even though these beds may be polluted by sewage to a certain extent, have ever caused disease.

But we cannot say the same of "floated" oysters. It is to them that the finger of suspicion points. For here we have very different conditions. Here we find instances where oysters have been placed directly at the mouths of typhoid-laden sewers or in typhoid-laden creeks for hours just previous to sale. No better scheme for the direct infection of such shellfish could be found unless the germs were inserted directly between the shells.

As to whether or not the practice of floating in itself is a proper one is a subject which has been hotly discussed for some time. But in regard to floating in polluted water there can certainly be no difference of opinion.

The arguments usually advanced in favor of floating are that it removes the grit and mud and slime from the interior of the oysters and improves their flavor and keeping qualities. Those advocating the practice usually fail to add also that it bloats and swells the meats by the absorption of a large amount of water which can then be sold at the price of oysters. It has been said that the profit from this increase in bulk is often sufficient to pay all expenses of opening the oysters. From this standpoint then floating constitutes fraud and adulteration under the Pure Food and Drugs Act. Those who are unbiased in their opinion all agree that the only real advantage gained by floating is the cleansing from mud and slime, and this can be accomplished just as well by holding the oysters in clean salt water for a while. The fact that it is practically impossible to find any stream of fresh water which is free from all pollution should deter any conscientious oyster grower from carrying on this practice. That floating

is indeed dangerous and accomplishes nothing in the improvement of the stock is recognized by the Pure Food Board because they are at present considering the withdrawal of their sanction of the practice in any form and prohibiting it altogether.

I think you will all agree with me then in answering the first question, when I say that as far as the public health is concerned, for the present at least, all that is necessary is to prohibit this practice of floating oysters. Until further evidence is produced oysters taken directly from the beds on which they are cultivated may be considered safe in practically all cases.

Investigations have not been carried far enough as yet to say whether the same applies to clams, quahogs, and mussels or to the natural set of oysters which are occasionally found in small quantities in heavily and directly polluted waters.

This brings us to a consideration of the second question. How much sewage pollution, not in itself dangerous, but merely dirty, shall we permit in our oysters or other shellfish before we prohibit their sale? This opens up the whole matter of standards of purity. Think of the years of discussion on this subject in our studies of water supplies. Shall colon bacilli in 1 cubic centimeter, 10 cubic centimeters, or 100 cubic centiemters condemn water? It was only when the sanitary survey came to our rescue that we were able to answer this question satisfactorily. We are at present trying to work out standards in our milk analyses. Shall it be 500,000 bacteria per cubic centimeter, 100,000 per cubic centimeter or 10,000 per cubic centimeter? The conditions which enter into the shellfish question are just as complicated as in water and in milk. Before satisfactory laws can be passed regulating the industry much more light must be thrown on the subject than we have at present.

At first the Pure Food and Drug Board adopted the practice of condemning a lot of oysters if three out of five examined showed colon bacilli in one-tenth of a cubic centimeter of the shell liquor. We in Rhode Island followed their lead, and under the law passed at the January session, 1910, we passed or condemned oyster beds in Narragansett Bay by this standard. This gave us results which coincided with the conditions shown by the sanitary survey.

The examination of beds was made in the summer so that the certificates could be issued at the opening of the oyster season in the fall. But on examining some of these beds again later in the winter it was found that if this same standard was used every bed in Narragansett Bay and Providence River would easily pass inspection. Indeed beds in immediate proximity to sewer outlets showed the absence of colon bacilli in all five oysters examined even in cubic centimeter amounts of the shell liquor, a far better result than that given by oysters from far down the Bay, beyond all sources of immediate pollution during the summer.

Obviously the same standard could not be used in winter as in summer, and the question immediately arose ought we to prohibit the use of oysters when they come from near a sewer outlet when analyses show them to be as free from the colon bacillus as many of our best drinking waters? Simply because they are in polluted water should they be condemned though analysis shows them to be better than what we consider the best oysters in the summer? Under such

conditions our sanitary survey fails us. We have no standard by which to judge the purity of such shellfish. We are at a loss as how to proceed. Must we have a separate standard for summer and winter?

Of course in a measure we have this now, for no very considerable quantity of oysters is marketed at present in the warmer weather. The old idea as to the oysters being fit to eat only in the R months seems in a way to be borne out by this observation of seasonal variation in the bacterial content.

Almost the same question has arisen in regard to the use of oysters grown in waters into which disinfected sewage is discharged. Disinfected sewage is not dangerous but is it dirty? Ought such oysters to be used for human food?

I believe that the only satisfactory way to handle this matter is to adopt a certain distance from discharging sewers within which it shall be unlawful to take shellfish for food.

These are some of the problems which are troubling us at present. But while we are working at them a very considerable amount of good has already been accomplished in the improvement of the industry along sanitary lines.

In the first place we have seen placed on the statute books of the State of Rhode Island laws which regulate the industry and protect it. Pollution of the waters of the State in which shellfish are grown is prohibited under severe penalty. The State Shellfish Commission must make examinations of and issue sanitary certificates for any bed on which oysters are grown for consumption as food before such oysters can be taken from the beds and sold.

The Commissioners are required to inspect all opening and packing houses and the methods in use therein and must issue certificates as to their sanitary condition before shellfish can be sold therefrom. They are also given the power to make any regulations concerning the construction and operation of such oyster houses as they may see fit in order to place them in proper sanitary condition.

As a result of such legislation we have been able to make a series of analyses of oysters from all the beds in Narragansett Bay and its tributaries at different seasons; also chemical and bacteriological analyses of the water at the surface, at the bottom, and of the mud at the bottom of a considerable portion of the Bay; a study of the tides, currents, temperatures, and densities of these waters; and a complete sanitary survey showing every sewer outlet, every source of pollution entering the waters of the Bay.

In addition to this, the oystermen have been awakened to the seriousness of the matter. Because of the activities of the United States authorities and those of the State, they have been forced to examine into their methods of conducting business and to make every effort to improve their methods along sanitary lines. They have co-operated nobly in the matter and have helped to bring about a complete revolution in their business, which has in many cases involved changes from methods which were as old as the industry itself.

But best of all has been the effect this campaign for clean shellfish has had upon the entire removal of some of the sources of pollution from the tidewaters of the State. Ultimately, of course, this is the goal which we seek, the return of our bays and streams to their earlier condition of purity. It may be a long time indeed before this can be accomplished, but we are glad to record that a beginning has been made.

The Commissioners of Shellfish summoned before them the parties interested in sewage disposal in the several cities and towns which were using Narragansett Bay as a common sewer. At this hearing they were required to tell what efforts they were making to comply with the law which prohibited the pollution of the tidewaters. They were informed that they must take steps immediately to remedy the conditions. As a result already some of them have moved in the matter. The City of Providence is already conducting an investigation of its methods of sewage disposal and has begun the disinfection of its effluent. Other towns are doing something. Much remains to be done. Rhode Island even has a bone to pick with Massachusetts, for there seems to be some interstate traffic in sewage which we hope in time to see remedied.

In conclusion, then, were I asked along what lines at present can we best effect improvement of the shellfish industry I would say:

1. Prohibition of the practice of floating oysters.

2. Prohibition of the use for food of shellfish taken from waters directly polluted with sewage, that is, within a certain distance of discharging sewers.

3. Careful sanitary regulation and supervision of the methods of handling and packing shellfish.

4. Efforts to secure the removal of sewage pollution from the tidewaters where shellfish are grown, or at least the disinfection of all sewage effluents which enter tidewater.

Discussion.

Prof. WHIPPLE. The subject of oyster sanitation is a most interesting one and it may interest you to know that a committee has been studying the subject, in the American Public Health Association, for the past year or two. A preliminary report was made at Havana a few weeks ago and this will be published in due time. (This Journal, January, 1912.—Ed.)

What Prof. Gorham has said in regard to the winter conditions of oysters seems to be true not only of oysters in the Providence River but also of oysters found in this country farther south. During the winter season the bacteriological analyses of all oysters seem to be better than during the summer season. It looks as if the oyster was a more intelligent being than we have given him credit for, because, knowing that we appreciate his society only in the winter, he apparently takes particular care to protect himself against sewage and other filth during this season in order that he may not do us damage or injure his own reputation. I have sometimes wondered why, if that is the case, it is necessary to go to the expense of disinfecting sewage in the way that Prof. Phelps has outlined. If the oyster protects himself why is it necessary to spend money to further protect him? In reply, there is this to be said,—that the oyster is no Pharisee. Neither during the winter, nor at any time, does he attempt to keep clean the outside of his shell and there is a real danger at all times that polluted mud that has not been thoroughly washed off may get into the half shell in which the oyster is served. Many oysters have a small cavity near the hinge which is difficult to clean and which is often filled with mud when served. If this mud gets into the bowl, as it may easily do, there is a danger that it may also get into one's mouth.

Then of course there is the further question of general cleanliness. No one desires to eat food that is unclean. Our committee is trying hard to devise

some practical standard which can be applied to bring this about. Prof. Gorham has marked out some of the ways in which this can be done. One other method has been suggested and the committee is working along this idea at the present time and will doubtless report upon it later, viz., a method of "scoring" the oyster beds and the oyster houses, very much as milk farms are now scored. By this method some appropriate authority would give a good score to the oysterman who raises oysters on clean grounds and who harvests and markets his oysters in a clean way, and a low score to the man who is careless in handling his goods and grows his oysters very near a sewer.

I think the whole question of the sanitation of the oyster is one that is rapidly clearing itself up. To some it may seem to be growing more and more complicated, but now that the oystermen are co-operating with the sanitarians we are learning many facts hitherto unknown, and I think that in a short time we shall be able to establish certain standards that will satisfy the sanitarians and that can be lived up to by the oyster growers.

Mr. WILLIAMS. When I accepted the invitation of my local board of health to attend this meeting I knew that I would be greatly rewarded by listening to the papers that were to be read here, and I was especially interested, of course, in the paper that Professor Phelps was to read. I have had a number of very interesting meetings with Professor Phelps and Professor Sedgwick with regard to the disinfection of sewage.

New Bedford, as you may know, has been doing its best to become a large city and in doing so it has had to meet a few of the ills that come with municipal growth and development, one of which is the very serious pollution of the river upon which it is located. This body of water which we call the Acushnet river, is really only a tidal arm of Buzzard's Bay. But we have succeeded in polluting it to such an extent that a few years ago the State Board of Health prohibited the further taking of shell fish from its waters. These shell fish, of course, did not include oysters. They did include the famous little neck clams, which, I understand, we have distributed to quite a considerable extent over various parts of the country.

In order to relieve ourselves from a very serious situation and to save a business which furnishes employment to a great many of our citizens the city undertook, two years ago, to provide for a further disposal of its sewage. We have now started upon the construction of an intercepting sewer which will collect all the sewage of the city and deposit it at a point in Buzzard's Bay something over half a mile from the most extreme point of land in New Bedford. Furthermore the sewage will be delivered in water about 30 feet deep at low tide where it will also come in contact with the great tidal movement of the water of Buzzard's Bay.

When we announced our intention some of our neighboring shore towns became seriously alarmed as to what the effect might be upon their shores, and so, to relieve them of any cause for alarm, we consulted with Professor Sedgwick and Professor Phelps and thereby learned of their great interest in the disinfection of sewage. Disinfection of sewage, of course, has been generally known about in one way or another for a good mnay years, but up to this time none of us knew of any practicable way of disinfecting raw sewage.

You probably understand that our situation was such that we could not very well introduce sand filters, because we didn't have the sand areas suitable for the purpose, and contact filters were also a very expensive method of treatment for a city situated as we are. And so we have decided that the proposition of Professors Sedgwick and Phelps was worthy of our consideration. We have gone into the subject to a considerable extent; and we have decided that we will provide at a point near the outlet of our intercepting sewer for disinfecting the crude sewage by the addition of chloride of lime, or ordinary bleaching powder if later it is definitely decided to adopt this method of treatment. While our plant is not yet built we are preparing plans with that object in view.

Gentlemen, that, in a few words, places New Bedford's position before you. I thank you very much.

Prof. PHELPS. There have been, Mr. Chairman, two things said here about the oyster that I want to say do not apply to the clam. First, Professor Gorham says the oyster loves clean waters and will not grow near sewers. That certainly does not apply to the soft shell clam. Then Professor Whipple tells us the oyster shuts up and fasts in winter. That, according to my observation, the soft shell clam does not do. And so, however we may remove suspicion from the oyster, I think this clam situation is going to still be with us. It is certainly true that the clam is inherently a filthy beast. He seems to prefer polluted waters and grows fatter and faster in them. The oyster may be wise and we may possibly trust to his discretion, but the clam, proverbially happy, needs the guardianship of the State to keep him from falling into evil ways.

Mr. STEPHEN DEM. GAGE. I have been much interested in Professor Gorham's paper and am particularly pleased that he has drawn the distinction so sharply between polluted or dangerous oysters and oysters that are merely dirty. The shellfish situation in Massachusetts is quite different from that in Rhode Island and in the States further south. In these States the oyster is the only mollusk of any economic importance. The hard and soft clams apparently are unable to grow south of New Jersey and the few beds of these clams which existed at one time along the shores of Long Island Sound and in Narragansett Bay have been practically depleted. Even the clams for the famous Rhode Island clambakes are now brought in from Massachusetts sources. On the other hand, north of Massachusetts, the oyster industry is so small as to be negligible, but the gathering of hard and soft clams and of scallops is an important industry. Massachusetts lies intermediate between these zones and along different portions of her coast all of these various types of shellfish are gathered in greater or less quantities. In 1909, the Massachusetts Fish and Game Commission published a special report on the Mollusk Fisheries in the State and some statistics from that report showing the relative amount and value of these different shellfish gathered annually may be of interest. The number of men employed in the oyster industry was 159, in the scallop industry 645, in quahaug or hard clam industry 745, and in soft clam industry was 1,360. The catch of oysters is about 115,000 bushels per year valued at $148,000, of scallops 86,000 bushels valued at $164,000 ,of hard clams 144,000 bushels valued at $195,000, and of soft clams about 154,000 bushels valued at about $150,000. It will be observed that the value of both the hard and soft clam industries is greater

than that of the oyster industry and that the number of bushels of hard and soft clams produced is each much greater than the number of bushels of oysters produced. Furthermore, there is a still greater difference in the food value of these various shellfish owing to differences in thickness of shell and differences in actual food value of their bodies. Computed on this basis the oyster industry produces only about 8 per cent., while the hard clam industry produces about 17 per cent. and the soft clam industry produces over 37 per cent. of the food value of the entire shellfish industry.

For more than ten years the State Board of Health has been studying the question of the pollution of these various kinds of shellfish, and in certain instances, areas which are dangerously polluted have been closed. The question of the pollution of clam flats is the most serious problem, however, as not only is the soft clam industry more important from an economic viewpoint, but the flats from which soft clams are found are widely distributed along the shores of the State and as has already been stated, the soft clam will grow and thrive in shallow water in close proximity to public sewers, while the other mollusks mentioned are natural inhabitants of deeper waters where pollution is reduced to a greater or less extent by dilution.

CHAIRMAN'S ADDRESS, SECTION OF MUNICIPAL HEALTH OFFICERS AMERICAN PUBLIC HEALTH ASSOCIATION

DR. A. J. DOUGLAS,

Medical Health Officer, Winnipeg.

I desire to express to the members of this section my deep gratitude for the great honor they have done me in electing me its Chairman; I can recall no position which has ever been bestowed upon me in which I take as much pride.

I approach its duties with all humility and thoroughly recognize that there are many men here, who by attainments, experience and achievements could fill this position far more worthily than I can hope to.

The Section of Municipal Health Officers, while one of the youngest in our association, is, in a measure the most important, for it concerns itself with the men who are possibly most actively engaged in the cause of public health —the men who are, as it were, on the firing line. The laboratory workers, the vital statisticians, the sanitary engineers and the sociologists, point us the way; they indicate the lines along which our efforts should be directed and show us what we may do to control and prevent the scourges which afflict mankind.

But the task of organizing the campaign and fighting the battles is upon our shoulders and entrusted into our hands. To us is given the difficult and oft-times thankless task of coaxing or driving people to do things for their own good and that of others which they do not wish to do.

If what we accomplish while meeting together causes us to become more efficient; if it helps bring about results to make the place from whence we come a better, healthier place to live in; if it makes us sanitarians in the broad sense of the word, we shall warrant our existence as a section.

The American Public Health Association is now an old organization which has attached to its name a history of high ideals and worthy deeds accomplished.

The Laboratory Section has done and is doing a splendid work; the Section of Vital Statistics, still young, is ably fulfilling its mission; I trust that ere long our section may be able to point to land marks that it has made in the history of preventive medicine.

In the public health renaissance that has taken place during the past ten years the position of the municipal health officer has increased enormously in importance and his relation to society has undergone a great change.

Even as short a time as eleven years ago, when I first took office, the health officer, in my community at least, was looked upon by most people as a rather unnecessary appendage to the municipal pay roll—not only unnecessary but very often pernicious, for sometimes he had the temerity to interfere with citizens, particularly the so-called best citizens' inalienable rights to do as they pleased.

It was considered that his proper sphere was to supervise the collection of city wastes, to keep the streets clean, to juggle with statistics (always with a

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view to emphasizing the salubrity of his own locality), and to occasionally show some activity during outbreaks of the more serious communicable diseases. But should the particular outbreak he was engaged upon not promptly subside under his efforts he might be used as a convenient scapegoat for its presence and be removed to make room for someone else.

He was always to use discretion as to whose toes he trod upon; he was not to point out glaring sanitary defects in his community as this spoiled business and kept visitors away. His office was commonly situated in a sequestered corner of the municipal building, preferably the basement; his staff was undermanned, often made up of incompetents appointed for almost any reason but that they were practical sanitarians. His salary was usually small and the appropriation for the upkeep of his department was kept down almost to the vanishing point.

One of the most hopeful signs of the times is the manner in which this state of affairs has changed and is changing. The change is almost wholly due to increased interest on the part of the public in the problems of hygiene. The public is slowly grasping the fact that there is another medicine than the old one which aimed only to cure disease, it is beginning to discover the new medicine whose object it is to keep people well by instructing them how to avoid disease, and by remedying all conditions which are dangerous to health. In this sanitary propaganda the municipal health officer has borne a part, and he is every day becoming a greater factor in it. This is right and proper, and it should be the resolve of this section and every member of it to further the movement as much as possible.

The health officer is becoming more and more a publicity agent and an educator; the old policy of silence in health matters is being discarded and they are now being treated with the utmost frankness. Information is given out by the health officer himself over his signature, or from the lecture platform, stating what conditions exist and what should be done to remedy them; the public is beginning to drop the old apathetic and critical attitude and is showing a disposition to do things when told what to do. No just cause ever suffers from a clear and true statement of facts, and this has been borne out time and again in sanitary work. Governing bodies are beginning to appreciate this, and where the suggestions of the health officer formerly met with indifference or opposition, he is now assured of a respectful hearing and usually of co-operation and financial support.

The press and the magazines are manifesting an enthusiasm in the work and are glad to publish authoritative statements—they will print columns of advice. The innovation of a daily health article recently introduced by a great newspaper, the Chicago Tribune, under the guidance of a distinguished member of our section, is very significant and commendable; it should prove of inestimable benefit not only to the citizens of Chicago but of the whole United States and even further afield.

It is thus abundantly evident that in modern hygiene more stress is being constantly laid upon publicity and popular education; we should therefore encourage all things that accomplish these ends. The good work for the cause that can be done by the issue of a departmental bulletin and by educational leaflets is, in my opinion, great.

Exhibits, accompanied by illustrated lectures covering the varied sphere of our activities, are, I consider, of the utmost importance. I should like to see health exhibits established as permanent institutions, at least in the larger centres. When people can see for themselves conditions in their own community set forth in a graphic and unmistakable manner, with the right way and the wrong way side by side, it cannot but have the effect of waking them up to the need of putting their own houses in order and making them better and more useful citizens. The fact that the public is beginning to appreciate our efforts and objects constitutes our opportunity, and it behooves us to keep abreast of the times and put forth our energies to keep this interest alive.

While many communities are doing things for sanitary betterment, there are many that are not. What can we do to help the backward ones? I would offer one or two suggestions:—

The tenure of office of the health officer is far too insecure in many cities and towns, and his reward too small to encourage competent men to give their best services and put their hearts into the work.

If it were within the power of this section and association to do something that would make it possible that only men either with previous experience or with a preliminary education in which special attention has been paid to public health, be appointed to the positions of health officers, and when appointed that they could only be removed for cause, I feel certain that a great advance in general efficiency would be made.

There are still being appointed to these most important positions men who have had no previous experience or training which would fit them for the duties they are about to undertake, and when these men have by their own exertions acquired a wealth of valuable experience and become useful and competent officials, they are removed through a change in administration and the same process is gone through again. I am aware that this is a most difficult problem for any association to deal with as the evil is widespread and flourishes under so many different conditions.

Another point which should be emphasized is the entirely inadequate remuneration allowed municipal health officers in many places, often making it impossible for them to devote their whole time to the work. It should be impressed upon governing bodies that the man to whom is given the onerous duty of guarding the health and lives of citizens should be paid in keeping with his high calling.

If security of office and good salaries were assured municipal health officers, and the services of competent men generally insisted upon, I feel certain death rates would be lowered all over the continent and more men would adopt public health as a profession.

A number of universities in the various countries represented here are now giving courses for the diploma of public health which ensures a constant supply of trained hygienists.

What has been said of the health officer himself is almost equally applicable to his assistants (and without good assistants a departmental head is badly off), I feel sure that every one of us here has experienced difficulty in obtaining and

keeping efficient medical, sanitary, and meat and food inspectors. Too often these are appointed not for their technical knowledge and ability to apply it, but from the fact that they possess that mysterious but potent attribute, a pull.

In America, so far as I am aware, there is no organization similar to the Royal Sanitary Institute of England which trains inspectors for the various posts in health departments and confers diplomas upon completion of its course and the passing of its examinations. This institute has done much to further public health in Great Britain and her colonies, and I can speak from personal experience as to the efficiency of the training its graduates receive. The examinations of the institute are held at stated times in various centres throughout the British Empire; an applicant does not need to leave his own colony to take the examination in most cases.

A plea for an American or international institute along similar lines was put forth in the columns of our Journal not long ago, and I would recommend the idea to your consideration.

If such an institute is ever started on this continent I should like to see it under the Aegis or with the approval of this association and this section.

If an institute of this character were in operation and its qualifications generally recognized a time would come when it would be difficult or impossible for an incompetent to obtain a position in an up-to-date department; the standards of departmental efficiency would everywhere be raised; we would be employing from the start, men who know and would not have to be taken by the hand and taught their duties, at the public expense, and through their own mistakes, a process which usually takes years and which sometimes is never accomplished.

Is it not within the province of this section to inaugurate or lend its support to some movement which will eventually react for the public good by making for the appointment of trained men to the various positions in sanitary work and assure an adequate recompense and proper tenure of office after such appointments have been made?

A MOSQUITO LARVACIDE--DISINFECTANT AND THE METHODS OF ITS STANDARDIZATION

S. T. DARLING,

Board of Health Laboratory, Ancon Hospital, C. Z.

To the sanitarian in the tropics no subject is of greater importance than the destruction of mosquito larvæ. One of the means used toward this end by the Sanitary Department in the Canal Zone is a [1]larvacide prepared from crude carbolic acid, the details of manufacture of which were worked out by Mr. J. E. Jacob, Chemist, Board of Health Laboratory.

The special features of the product are its cheapness, high larvacidal and germicidal powers, miscibility with water, relative uniform composition and the methods used to determine its larvacidal and algacidal value.

In the work of destroying algæ and mosquito larvæ in the Canal Zone, large quantities of the larvacide are used, the amount averaging 250 barrels a month, and a plant erected for its manufacture has been in operation over two years.

The larvacide is prepared from crude carbolic acid, a substance which as usually supplied contains from 5 per cent. to 30 per cent. tar acids, together with a large amount of inert neutral oils. The crude acid is immiscible with water and is a very inefficient disinfectant on account of its inability to come into intimate contact with microörganisms. When, however, the crude carbolic acid is made into a liquid soap with resin and alkali by means of heat, a product results which emulsifies upon the addition of a large amount of water. If the germicidal value of the emulsion is determined by the method of Rideal and Walker it will be found to be greatly enhanced, frequently being from two to five times greater than that of pure carbolic acid.

The product is not only a most effective destructive agent for mosquito larvæ, but is a valuable cheap disinfectant.

Method of manufacture: To insure the manufacture of a uniform product requisitions call for crude carbolic acid of a specific gravity not greater than 0.97 and to contain not less than 30 per cent. tar acids. Each consignment of crude carbolic acid received is assayed at the Laboratory to determine its specific gravity and percentage of tar acids, for it is necessary to keep the product of a specific gravity approximately that of water so that it will diffuse rapidly and not sink to the bottom nor remain on the surface.

One hundred fifty gallons of crude carbolic acid are heated in an iron tank having a steam coil with steam at 50 pounds pressure. Two hundred pounds of finely crushed and sifted common rosin are dissolved in the heated acid and then 30 pounds of caustic soda dissolved in 6 gallons of water are added. There

[1]Darling, S. T., Studies in Relation to Malaria, Isthmian Canal Commission, Department of Sanitation, Laboratory of the Board of Health, Washington, Government Printing Office, 1910.

[2]Darling, S. T., Factors Concerned in the Transmission of Malarial Fever in the Isthmian Canal Zone, Annals of Tropical Medicine and Parasitology, University of Liverpool, 1910, iv., 179.

[3]Report of the Department of Sanitation of the Isthmian Canal Commission for the month of August, 1909, W. C. Gorgas, Colonel Medical Corps, U. S. Army, Chief Sanitary Officer, Washington, Government Printing Office.

is a mechanical stirring rod attached to the tank. The product is ready in a few minutes, yielding about 3½ barrels.

Cost of manufacture, August, 1909:

Amount manufactured, 14,600 gallons (292 barrels).

12,600 gallons crude carbolic acid at .12 per gallon....	$1,512.00
12,300 pounds rosin at $2.48 per hundred.....	305.04
2,550 pounds caustic soda at $3.70 per hundred.....	94.33
Two tons coal, $5.00 per ton.....	10.00
Labor	92.46
Supervision	50.00
Total	$2,063.83

Cost per gallon, $0.1413.

The germicidal value when tested with B. typhosus in an aqueous emulsion of the larvacide has an R-D coefficient of from 2 to 5.

As a mosquito larvacide it is used by spraying an aqueous emulsion (one part of larvacide to five of water) over the surface and along the margins of pools and ponds or other mosquito breeding places so that the resulting dilution of the larvacide has a thin milky opalescence representing approximately a dilution of 1 to 5,000.

From time to time tests are made of its larvacidal powers. This is done by preparing dilutions of 1 to 5,000, placing the resulting emulsion in moist jars or other large glass vessels and introducing Anopheline, Culex or Stegomyia larvæ into the jar and noting the time required to kill the larvæ, or the time when they leave the surface and are unable to rise.

After the introduction of larvæ into the emulsion by means of a pipette they are seen to show signs of excitation, with loss of the sense of direction. This is followed by convulsive movements, after which they sink to the bottom, but may rise several times before being killed. As anopheline larvæ commonly remain on the surface for long periods, it is necessary during the test to touch them gently with a wire or pin to ascertain if they have been killed. If they are dead they will, upon being gently pushed beneath the surface, sink to the bottom and remain there. This gentle manipulation does not hurt them in any way, for larvæ in control jars have been handled in this way for days without interfering with their subsequent development.

The larvacidal powers vary slightly with different grades of crude carbolic acid, but an average result is as follows:

Dilution 1 to 1,000—Culex larvæ, dead in 5 minutes; Anopheline larvæ, ½ grown, dead in 5 minutes; Anopheline larvæ, full grown, dead in 10 minutes.

Dilution 1 to 5,000—Anopheline larvæ, ½ and full grown, dead in 5 minutes; Culex larvæ, ½ grown, dead in 3 minutes.

Dilution 1 to 10,000—Culex larvæ, ½ grown, dead in 64 minutes; Anopheline larvæ, young, dead in 52 minutes; Anopheline larvæ, full grown, dead in 135 minutes.

Dilution 1 to 15,000—Culex larvæ, small, dead in 32 minutes; Anopheline larvæ, dead in 123 minutes.

Anopheline larvæ are slightly more resistant than Culex larvæ, and all pupæ are more resistant than larvæ to the effects of the larvacide.

With a larvacidal agent so destructive to mosquito larvæ and bacteria it is natural to inquire what loss of efficiency occurs when the larvacide is placed in pools in contact with algæ and protozoa, and how often it will be necessary to re-apply the larvacide for the purpose of destroying mosquito larvæ. If its powers are lost in destroying all the mosquito larvæ in a given pool, then assuming that mosquito eggs are laid on the pool immediately afterward, it will be necessary to reapply before that brood pupates, for pupæ are more resistant to the powers of the larvacide and the latter cannot be depended upon to destroy them. I have found by breeding anophelines in the Laboratory that for *A. albimanus* the egg period is about 36 hours; the larval period about 9 days, and the pupal about 2 days. As these periods are very likely a little shorter out of doors where there is abundant sunshine and food, the sanitary inspectors reapply the larvacide every 7 days. In this way they aim to destroy all broods in the larval stage and thus prevent breeding.

While the larvacide in dilutions of 1 to 5,000 is toxic to mosquito larvæ and destructive to algæ and protozoa, and its efficiency lowered, it is not absolutely destroyed, for it will be seen upon inspection of pools and artificial test tanks that the water retains some of its opalescence for several days.

Very little appears to have been done on the subject of the heightened power of emulsified germicides over those in solution. According to Chick and Martin†, Henle found that "creolin," which is an emulsion of tar acids (analogous to the larvacide described here), was a more efficient disinfectant than could be explained upon each of its constituents separately, and concluded that the extra efficiency is connected with the emulsified form; and that Rideal and Walker stated that an emulsion of "Tricresol" was equal in germicidal power to a solution three times as concentrated. Chick and Martin, from their experiments with B. paatyphosus and staphylococcus pyogenes aureus, are of the opinion that "there is little doubt that the removal of an emulsion of tar acids by bacteria is in the first instance a process of adsorption and not a chemical combination, and that disinfectants of this class possess superior efficiency because owing to this adsorption the bacteria rapidly became surrounded by the disinfectant in much greater concentration than exists throughout the liquid."

This, I believe, holds true for algæ and protozoa. When emulsions of larvacide are put up with large quantities of algæ, such as *spirogyra*, the larvacide loses its turbidity, 50 per cent. being lost in some concentrations within two hours. Microscopic examinations fail to disclose a cause for this loss of turbidity.

When freshly prepared and exposed to algæ it is seen that the emulsion contains globules of various sizes ranging from the larger, which are about three m. in diameter, to those just visible with the highest powers, and the disturbance of the fluid due to Brownian motion indicates that there are myriads of ultra-microscopic particles and that the "bombardment" of the surface of the algæ is more marked on the part of the smallest particles. When the

† Chick, H. and Martin, C. J., Jour of Hygiene, VIII. 698, 1908. "A Comparison of the Power of a Germicide Emulsified or Dissolved with an Interpretation of the Superiority of the Emulsified Form."

interior of the algæ was scrutinized for globules of larvacide, although few were seen, it did not appear that they could account for the loss of turbidity. A good deal of the loss of turbidity appears to be due to the formation of larger globules, thus imparting a darker color to the emulsion, and thus removing part of the opalescence, as in the formation or separation of cream from milk, and this separation must remove a large portion of the larvacide from contact with bacteria and algæ.

Oil globules were not generally adherent to the outside walls of the algæ and they were not always agglomerated, though this was observed in some preparations.

After a week's exposure of algæ to larvacide, some globules from 1 to 3 m. in diameter were found in the interior of the algæ; and this suggests that the "bombardment" of microscopic and ultra-microscopic particles of larvacide finally results in its penetration of the algæ, and that when a large amount reaches the interior, fusion of the particles results.

The gradual loss of efficiency of the diluted larvacide when in continued contact with algæ was determined by exposing larvæ to freshly prepared mixtures of larvacide plus algæ and protozoa, and to mixtures of the same that had been in contact from 1 to 7 days. As an additional control the effect was noted of placing larvæ in fresh water with algæ which was not aerated, for in this instance a pellicle forms on the surface of the water and the algæ and larvæ die.

From an inspection of the following table it will be seen that the larvacide when freshly prepared destroys mosquito larvæ within a few minutes—see second horizontal column.

The table shows that the efficiency of the larvacide lasts for at least 7 days and certainly longer. It also shows that when in contact with algæ for a period of 1 to 7 days, 70 per cent. of the larvæ are destroyed within 48 hours.

It is seen that the larvacide hastens pupation; and the algæ control shows that when larvæ are placed in contact with fresh algæ and fresh water the larvæ pupate naturally for several days; decomposition, however, sets in after 110 hours with the formation of a pellicle of bacteria and protozoa on the surface. The anaerobic conditions beneath the pellicle cause the death of algæ and larvæ. This may be prevented when it is desired by aerating the tank with an air jet.

Published with the approval of Colonel W. C. Gorgas, U. S. A., Chief Sanitary Officer, Isthmian Canal Commission.

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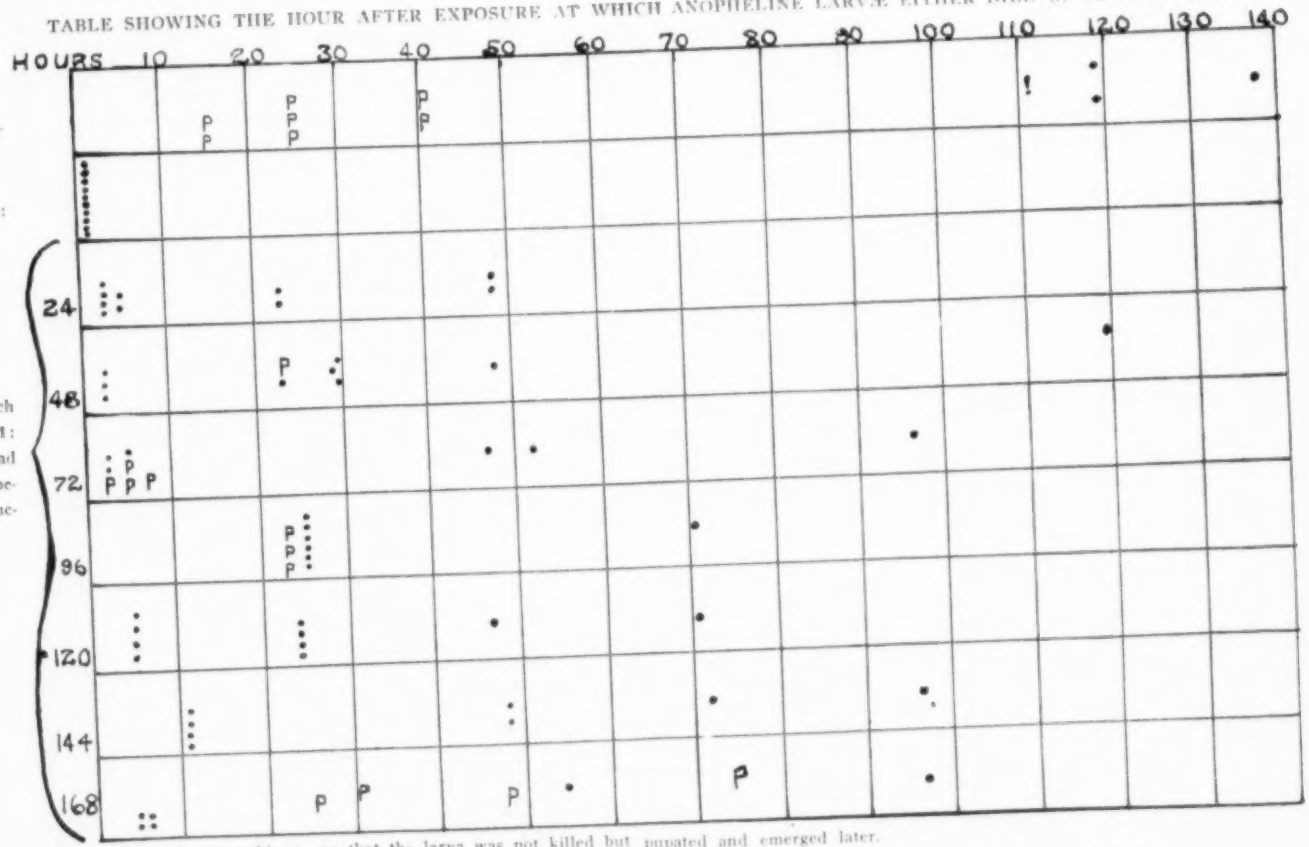
TABLE SHOWING THE HOUR AFTER EXPOSURE AT WHICH ANOPHELINE LARVÆ EITHER DIED (·) OR PUPATED (P).



Algæ and water control.

Larvacide control 1: 5000.

Hours during which the larvacide 1: 5000 and algæ had been in contact before the introduction of larvæ.

P=pupation of larva; this means that the larva was not killed but pupated and emerged later.
·=the hour after exposure to the test when the larva died.
!=after 113 hours a pellicle formed on the surface and an odor of decomposition was present, causing the death of larvæ.

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A NOTABLE STUDY OF THE COLD STORAGE QUESTION

In connection with the pure food agitation which during the last few years has run like an epidemic all over the land cold storage has not escaped attack. It has been freely alleged that by the cold storage of foods the public health has been endangered and the cost of living increased. A carefully prepared report by a Massachusetts commission created by the legislature and appointed by the Governor to investigate these questions has just been made public and throws a flood of light upon the whole subject. Some years ago the State Board of Health of Massachusetts by order of the legislature made a report on the cold storage of drawn and undrawn poultry, based upon investigations made at its request by Dr. Boos. The present report comes from a special so-called "Cold Storage Commission" and covers a much wider field. The membership of the commission includes persons practically familiar with the subject, and its secretary was Professor F. Spencer Baldwin of Boston University, a political economist of high standing who had already the year before served on a State Commission on the Cost of Living. The commission held public hearings and heard much testimony so that the report is lengthy and covers almost the whole field.

The report states that "with respect to the influence of cold storage on health, the commission finds that in the main it is beneficial. While abuses have arisen, through the holding of food products in cold storage for unduly long periods and through the handling of goods by improper methods before and after, as well as during, refrigeration, the benefits that have come from the salvage of food through cold storage far outweigh any evils that have developed in this field. Cold storage has brought about an expansion and diversification of the food supply of the population, making certain kinds of food more abundant and more accessible. It thus makes for the conservation of the vital resources of the people. The gain from this source is universal and permanent; the injuries are occasional and temporary, and can be eliminated by proper regulation."

The following are in detail the conclusions of the commission with regard to the connection between cold storage and public health:

1. A progressive deterioration takes place in perishable food products kept in cold storage; the changes naturally occurring are greatly retarded by refrigeration, but are not absolutely suspended. Therefore, a food product that has been held in cold storage is never just as good as the perfectly fresh article, other conditions being equal.

2. The deterioration taking place during cold storage first appears in a change in flavor, which may effect the palatability of the food, but does not necessarily affect its wholesomeness or nutritive value.

3. The length of time during which an article of food held in cold storage can be kept wholesome and fit for consumption varies for different commodities.

4. The period of proper preservation for any particular commodity depends largely on the method of handling and preparing for cold storage.

5. Scientific investigation in this field has not yet been carried far enough to enable one to fix normal time limits of storage for different commodities.

6. On the whole, prolongation of the storage period beyond one year, even under correct conditions, appears to be undesirable, and prejudicial to the public health.

Nor does cold storage increase the cost of living. On the contrary, by saving up the surplus (which would otherwise be lost) against a period of scarcity, it prevents waste and virtually increases production. And since an increased production means a larger supply, this tends to cause lower, rather than higher, prices.

While realizing that the effects of cold storage on health and prices are generally beneficial to the public, the commission nevertheless points out that there is need of some legislation for the regulation of the business. "Cold storage is an industry of a public character. It plays a rôle in the distribution of the food supply analogous to that of the railway in the transportation of commodities in general. The railroads are 'common carriers;' the refrigerating warehouses are 'common storers.' A business of this kind should be subject to supervision and control by the State. The object of regulation should be to prevent abuses and protect consumers without imposing on the business unreasonable restrictions that would interfere with its legitimate operations and hamper its proper development. The measures of regulation should be of such a nature as to attain the object sought with a minimum of expense and inconvenience to the business interests affected."

In order to accomplish these results it is suggested that extensive powers be delegated to the State Board of Health with respect to the regulation of cold storage establishments. The following are the principal measures of regulation proposed:

1. Cold-storage warehouses should be subject to the supervision of the State Board of Health, and should be required to take out licenses and submit regular reports. The main object of the proposed inspection is to ensure the proper condition of goods upon entry into storage and their proper treatment during the storage period.

2. Food products deposited in cold storage should be marked either on the individual articles or on the containers with the dates of receipt into storage and of withdrawal from storage. The reason for this requirement is to afford

a means of identifying cold-storage commodities as such in the trade, and of conveying to purchasers information to which they are entitled with respect to the commercial history of the food products which they buy, including the length of time goods are held in storage. (Two members of the commission dissent from the recommendation with regard to the marking of the date of withdrawal.)

3. The time for which food products may be held in cold storage should be limited to twelve months, with discretionary power vested in the State Board of Health to extend the time limit for particular consignmen of goods, and also to fix a shorter time limit than twelve months for any article of food if such further restriction of the storage period should be found upon investigation to be desirable.

4. The fraudulent sale of cold-storage products as fresh goods should be prohibited. It is generally admitted that the purchaser has a right to know whether he is getting cold-storage or fresh food. A provision requiring that purchasers shall be informed upon this point is a legitimate and desirable measure for the protection of consumers against deception.

5. The return to cold storage of goods that have once been withdrawn and placed on the market for sale to consumers should be prohibited. Such goods are presumably not in fit condition for further storage. The prohibition of restorage is needed to protect consumers against a practice that unquestionably leads to abuses.

The commission recommends that the regulations apply to fresh meat and meat products, fresh food fish, poultry, eggs, butter and any other commodities that the State Board of Health may see fit to add.

To summarize it may be said that the two most important conclusions of the commission are (1) that cold storage is not to any great extent a public health question and (2) that cold storage does not ordinarily increase but rather diminishes the cost of living. It is however rightly recognized that cold storage foods, likek all foods, come to some extent within the purview of the guardians of the public health.

We are of the belief that the wide distribution of this report should have a great effect in disillusioning the public of many fallacious beliefs concerning the cold storage of food-stuffs, and should lead to a better appreciation of one of the most important discoveries of man.

IMPORTANT ANNOUNCMENT

At the meeting of the American Public Health Association, held in Havana, in December, it was voted that arrangements should be made for uniting so far as possible the offices of secretary and treasurer of the Association with the editorship of the Journal. The secretary of the Association, Dr. Woodward, very kindly consented to continue to act in that capacity until the Committee on Journal should have completed its arrangements.

The reorganization of the Journal having been effected, the Committee of Seven announces the election of Mr. Selskar M. Gunn of Boston, as secretary of the American Public Health Association, and of Dr. Livingston Farrand of New York, as treasurer. Mr. Gunn's address is 739 Boylston Street, Boston, Mass., and Dr. Farrand's address is 289 Fourth Avenue, New York City.

THE RELATION OF THE PUTRESCIBILITY OF THE SETTLING AND NON-SETTLING SUSPENDED MATTER IN SEWAGE.

DR. ARTHUR LEDERER,

Chemist and Bacteriologist, Sewage Testing Station, Sanitary District of Chicago.

When we speak of a raw sewage being "strong" or "weak," we have, ordinarily, factors in mind which are furnished by the chemical determinations of total organic nitrogen, organic carbon, chlorine, and possibly fats. To one who is dealing continuously with one and the same sewage the suspended matter will give a fairly good idea of the strength of the sewage. It is likewise apparent that certain relations can be established between some of the chemical constituents from a long series of analyses. However, in different localities all these factors and relations will be subject to modifications, the chief cause for which lies in the varieties of trade wastes likely to be present in the majority of American sewages. In a general way a stronger domestic sewage will require more dilution in a water course than will a weaker, as expressed by any of these factors above.

Up to the time of the introduction of the methylene blue putrescibility test, we have lacked a definite expression for the strength of a sewage from the standpoint of a prospective nuisance. Since the vast majority of sewages reach the surface water in an unpurified or partially purified state, it is clear that any determination in which the natural agencies participate (as is the case in the putrescibility test of Spitta and Weldert) must of necessity come closer to the actual changes occurring in water courses than a purely chemical test, such as the determination of "oxygen consumed." This is the more apparent when we consider that the different methods in vogue of determining "oxygen consumed" give rise to very perceptible differences in the results. The methylene blue putrescibility test, as is well known, depends upon the formation of a colorless leucobase as the oxygen in the sample becomes exhausted. The test has been made more valuable by Phelps[1], who worked out relative stability figures which serve as a numerical measure of the relation between the available oxygen and the oxygen required for complete oxidization. Since the reaction is a biologic one, an incubation temperature of 20° C. will favor the development of bacteria likely to take part in the self-purification of rivers, while a temperature of 38° C. will favor the development of a bacterial flora not likely to take part in nature. The methylene blue test is at present almost universally used in sewage purification plants, and serves its purpose well. The main objection to the test, however, has been the time which is consumed to obtain results. This is the chief reason why sometimes an incubation temperature of 38° C. is preferred to the more desirable temperature of 20° C.

(1).—"Putrescibility and Stability of Sewage Effluents." Contributions from the Sanitary Research Laboratory and Sewage Experiment Station, Mass. Institute of Technology, Boston, Mass.—Vol. 5, page 74.

Read before the Laboratory Section, American Public Health Association, Havana, Cuba, December, 1912.

Recently interest was awakened in the test for the loss of dissolved oxygen in a sewage mixture on incubation for a definite period of time under anaerobic conditions. The loss of oxygen, as determined quantitatively, serves as a measure of the stability of the sewage or the sewage mixture. This test is a more direct measure of the probable effect upon the stream than the methylene blue test. The test is not a new one. On looking over German literature repeated mention is found of "Sauerstoffzehrung" among the analytical data, the result of which is obtained by methods substantially the same as described above. Mention was first made of the results obtained with this method in this country in the report of the Lawrence Experiment Station for the year 1900 (Mass. State Board of Health). The test was also referred to recently as a good measure of stability by the writer[2], and by C. B. Hoover, of the Columbus Sewage Works.[3] Hoover likewise recognized that the analytical results usually employed to show the degree of purification effected by sewage treatment do not reveal quantitatively the relative stability, and hence can not be looked upon as reliable indices of the deoxygenating properties of sewages, sewage mixtures or effluents. As a result of a long series of tests he obtained certain definite relations for sewages, septic effluents and filter effluents as determined from a modified "oxygen consumed" test and the loss of dissolved oxygen on incubation, described previously. It may be possible to establish such a relation in dealing with one and the same sewage for a long time, but the relation is bound to differ in various places to a great extent. The method does not lend itself to a ready expression of the stability. Hoover measured his loss of dissolved oxygen by incubaton at 37° C. for 24 hours. There is a possibility, as Phelps' has pointed out, in certain effluents, particularly those from rapid filters, of oxygen becoming lost at this temperature without being consumed. The saturation point of oxygen at 37° C. is not over 7 p.p.m., and consequently there is a tendency for some of the dissolved oxygen to escape. Tight stoppers are not likely to prevent the escape of the released gas, nor are mercury seals adapted for routine work.

Recently Phelps[5] introduced his method of calculating quantitatively the stability of a sewage mixture from determinations made by anaerobic incubation at 20° C. for a given period of time. The sewages are mixed with water saturated with oxygen, and the total amount of oxygen is determined directly. The sample is then stored in a tight bottle for a suitable period of time and the oxygen redetermined. The rate at which the oxygen disappears under these conditions is a direct measure of the probable occurrence upon a stream. Under given assumptions, other than those actually occurring in a specific test, the following formula derived by Phelps may be used:—

$$C = \frac{\log \frac{O'}{O}}{Kt}$$

(2).—"The Influence of Storage and Various Preservatives Upon the Dissolved Oxygen in Waters."—Paper read at the 28th annual meeting of the American Public Health Assn., Milwaukee, Wis., Sept. 5 to 9, 1910.

(3)—"Method for Determining the Parts per Million of Dissolved Oxygen Consumed by Sewage and Sewage Effluents."—*Engineering News*, 65, pp. 311-12.

(4)—"Putrescibility and Stability of Sewage Effluents."—Contributions from the Sanitary Research Laboratory and Sewage Experiment Station, Mass. Institute of Technology, Boston, Mass.—Vol. 5, page 86.

(5)—"Report of Col. Wm. M. Black, U.S.A., and Prof. Earle B. Phelps, Concerning Location of Sewer Outlets and Discharge of Sewage into New York Harbor, 1911."—Board of Estimate and Apportionment.

In this formula C represents the percentage of sewage permissible in the water used for dilution under the assumed conditions, O' is equivalent to the dissolved oxygen in the mixture before incubation expressed in parts per million, O the dissolved oxygen after incubation. K is a constant which defines mathematically the rapidity with which the oxygen is used up in a mixture of water and sewage. From a specific test K is determined. The formula can then be applied to other cases. According to Phelps, K depends upon the character of the sewage matter and the concentration of that material in the sewage, and is independent of the extent of dilution or the character of the diluting water. Subsequent experiments made by the writer on crude sewages at the Sewage Testing Station of the Sanitary District of Chicago have proven, however, that the factor K is not independent of the amount of dilution. "t" represents in the formula the time which is allowed for the contact of water and sewage to produce the change in the oxygen of the mixture.

It occurred to the writer to utilize Phelps' quantitative expression of the stability of sewages to demonstrate the improvement of the liquid by the removal of the settling suspended matter and complete removal of all the suspended matter. The laboratory technique employed for these experiments was the same as employed by Phelps. Two dilutions were made as a rule on one and the same sewage. A dilution of 1 part of sewage to 8 and 10 parts of water from Lake Michigan has given satisfactory results. The time of incubation was 24 hours, and the temperature of incubation employed 20° C. The sewage was mixed with the lake water in a glass cylinder by a specially devised stirring apparatus to insure the least possible aeration. A portion of the same sewage was also filtered through a single layer of Swedish filter paper which removed all suspended matter and pseudo-colloids. The same dilutions were made as with crude sewage and the initial dissolved oxygen determined just as in the crude sewage mixtures. The same dilutions were also made on another portion of the sewage after the suspended matter had been allowed to settle for 4 hours. Citrate of magnesia bottles, with patent stoppers, obtainable at any drug store, have proven very efficient for these incubation experiments. They do not permit air to enter as do some of the bottles provided with ground stoppers.

All the results obtained were calculated on the basis of preserving 30 per cent. residual oxygen after a 24-hour period of contact or flow. Besides this test other tests were carried on, such as total solids, oxygen consumed, and organic nitrogen, in order to bring out the relation of the volatile organic carbonaceous and nitrogeneous matter in solution and suspension to the calculated permissible dilution. As mentioned previously, the factor K in Phelps' formula has not been found to be independent of the dilution. Special experiments carried on with 3 different dilutions on the same sewage have clearly shown that K will decrease with a lower dilution, and the factor C of course will be found to be correspondingly higher. It was further found that the difference in K between the lower dilutions is greater than the difference between the two higher dilutions. As yet the results have not demonstrated a constant difference between C (the percentage of sewage) resulting from the various dilutions, consequently an exponent has not been introduced in the original formula. The highest "C" value has been used to compare results. Values of

one and the same dilution only are given for a comparison of the permissible percentage of crude, settled, and filtered sewages in Table I. On the whole, the differences in the factor K in the different dilutions have not been materially different, and are hardly large enough to interfere with the intelligent interpretation of the results.

TABLE I.
Parts per Million.

Serial Number.	Solids in Crude Sewage.		Suspended Matter. Original.		After 4 Hours' Settling.		Oxygen Consumed.			Organic Nitrogen.			Per Cent. Permissible Sewage.		
	Total.	Vol.	Total.	Vol	Total.	Vol.	Crude.	Settled.	Filtered.	Crude.	Settled.	Filtered.	Crude.	Settled.	Filtered.
1	493	222	68	50	37	30	13.	5.5	4.6	7.5	5.1	4.3	24.6	27.5	42.
2	629	313	266	124	91	55	29.	17.	11.	9.5	...	3.1	18.3	19.2	51.
3	594	295	118	84	45	43	30.	25.	20.	7.1	...	...	4.2	5.0	11.1
4	630	335	162	119	52	40	37.	33.	23.	13.7	11.3	5.7	2.6	5.5	9.4
5	680	385	194	126	75	55	52.	33.	26.	11.9	7.1	6.3	5.0	7.3	11.8
6	654	344	227	127	67	44	51.	28.	23.	12.3	3.3	1.1	4.7	10.3	21.3
7	592	322	187	120	65	57	52.	37.	29.	10.5	5.5	3.3	3.0	5.4	13.3
8	642	318	206	107	65	50	45.	31.	21.	13.0	...	8.0	10.1	18.3	29.4
9	547	270	76	52	51	44	27.	25.	24.	5.9	4.8	2.7	17.7	19.1	29.8
Avg.	607	311	167	101	61	46	37.	26.	20.1	10.1	...	4.3	10.0	13.1	24.3

The striking feature of this table is the last column, indicating the ratio of dilution or the "per cent. permissible sewage" (C) of the filtered sewage as compared to the raw and settled sewage. The remarkable result is still more apparent in the following Table II., which indicates the improvement in percentages.

TABLE II.

Serial Number.	Suspended Matter. Per Cent. Removed by Settling.		Additional Per Cent. Removed by Filtration.		Per Cent. of Volatile Matter left in Solution. After		Per Cent. Reduction of Oxygen Consumed.		Per Cent. Improvement in Permissible Sewage.	
	Total.	Volatile.	Total.	Volatile.	Settling.	Filtration	Settling.	Filtered.	Settling.	Filtered.
1	46	40	54	60	91	77	58	65	11	71
2	66	56	34	44	78	60	41	62	5	179
3	62	49	38	51	86	71	17	33	19	164
4	68	66	32	34	76	64	11	38	111	262
5	61	56	39	44	81	67	37	50	46	136
6	71	65	29	35	76	63	45	55	119	353
7	65	53	35	47	80	63	29	44	80	343
8	68	53	32	47	82	66	31	53	81	191
9	33	15	67	85	97	81	7	11	8	68
Avg.	63	54	37	46	82	68	30	46	31	143

Looking over the average of the 9 experiments in Table II., we note, for instance, that on removal of 63 per cent. of the total suspended matter, or 54 per cent. of the suspended volatile matter, the actual improvement in the sewage from the standpoint of a prospective nuisance is but 31 per cent. Results similar to this have been obtained by C. B. Hoover. The sewages with the low suspended matter (experiments 7 and 9) have the low percentage improvement.

One exception is found in experiment 2 with a high suspended matter and a low improvement from a dilution standpoint. Now, when we turn to the results obtained by filtration we will note in Table II. that the removal of only 37 per cent. of suspended matter or 46 per cent. volatile suspended matter additional to sedimentation has shown an improvement of 143 per cent. for dilution purposes, or nearly 5 times the improvement gained by merely settling the sewage. Similar is the case with the carbonaceous matter as expressed in "oxygen consumed." A reduction of 30 per cent. of "oxygen consumed" is equivalent to an improvement of 31 per cent. in dilution, while an additional removal of 16 per cent. in "oxygen consumed" gives an actual additional improvement of 112 per cent.

A thorough study of these two tables will clearly bring out the fact that the removal of suspended matter *capable of settling in settling tanks constitutes an improvement* from the dilution standpoint much less than the percentage of suspended matter removed. Since we have to consider the improvement of any sewage or effluent from the standpoint of the degree of dilution required rather than from the standpoint of the reduction of any chemical constituents (as shown by analysis), the improvement made by settling consists mainly in the improvement of the physical character of the liquid by the removal of material which may cause deposits, and incidentally some improvement in the stability. However, the removal of an additional small quantity of suspended matter *not capable of settling*, by simple filtration will improve the liquid *far out of proportion to the percentage of volatile matter removed*. This permits of only one conclusion, that is, on a domestic sewage from a large area the finely divided slowly settling suspended matter and pseudo-colloidal matter not capable of settling make up the greater part of the putrescibility, due to the suspended and colloidal matter. This fact has been recognized before. Spillner[6] states that the organic sulphur compounds in sewages which afford the material for the development of hydrogen sulphide are found in much smaller quantity in the suspended matter, capable of settling, than in the dissolved colloidal and finely suspended matter which has been removed by filtration in these experiments.

In the present state of the science of sewage disposal we aim to destroy the finely suspended matters by oxidization. However, most of the sewage is discharged to-day either in a raw or settled state. If a device can be worked out to take care of the finely divided non-settling suspended matters without resorting to biologic treatment, a degree of purification may possibly be attained intermediate between settling and biological treatment, which in many cases may be sufficient to avoid the expense of the more thorough biological treatment.

In conclusion, the writer wishes to express his thanks to Prof. E. B. Phelps of Boston, and to Mr. Langdon Pearse, Engineer in charge of sewage disposal experiments in Chicago, for valuable suggestions, and further to Messrs. H. B. Hommon and F. Bachmann for their conscientious analytical work.

(6)—Discussion of Mr. Saville's Paper, "The Emscher Sewerage District and the Imhoff Tank."—*Journal of the Assn. of Engineering Societies*, July, 1911, p. 53.

Discussion.

MR. GEORGE W. FULLER. In my opinion this paper is a valuable one not only for the sake of the specific results which it records, but also on account of the weight which it gives to a decided step in advance with regard to laboratory methods.

The tests themselves show, as did those described by Clarence B. Hoover in the *Engineering News* of March 16, 1911, for sedimentation experiences at Columbus, Ohio, that the putrescibility of sewage is not improved by sedimentation to an extent indicated by the percentage removal of total suspended matters. In other words, the matters in sewage which putrefy readily are found to greater extent, comparatively speaking, in the finely divided particles which do not subside than in the coarser particles which readily deposit.

The use of oxygen for measuring the degree of stability of sewage is a method which has doubtless come to stay. Just how it can best be applied is difficult to state in all of its details. Different sewages would probably give varying results to an extent that will require care not to draw too precise conclusions from early data. The whole movement towards putrescibility tests and stability data as distinguished from the old-fashioned albuminoid ammonia, oxygen-consumed or Kjeldahl nitrogen, is one with which the writer is in full sympathy.

In outlining the historical development the paper of Dr. Lederer would be more complete had reference been made to the reports of the Royal Commission on Sewage Disposal of Great Britain. In their later reports they give considerable information relative to this general method of measuring the organic content of sewage effluents and sewage-polluted waters.

Much credit is due Prof. Phelps for his careful studies in developing stability tests on a practical working basis. The writer some years ago favored somewhat different lines of laboratory procedure, but it is best for all to follow a uniform method. Such a procedure should be the one in most general use, and that unquestionably is now the one developed by Prof. Phelps.

While endorsing the use of this method as a step which should now be adopted in all laboratories, the writer wishes to repeat his earlier comments in regard to the use of incubation temperatures of about 37° C. There is no doubt about the shortcomings of this temperature to some limited extent, as pointed out by Dr. Lederer. On the other hand, it is the contention of the writer that all these results are relative and not absolute, and that the working laboratory at a purification plant needs data as quickly as it is feasible to obtain them. Otherwise the value of the laboratory as an aid to practical operations is materially lessened.

It is noted that Dr. Lederer secures his results by incubation for 24 hours at 20° C. If our recollection is correct, Prof. Phelps used still shorter periods. So far as practicable it is believed that future developments should recognize the importance of the short period, whatever the merits and demerits may be of a temperature of 37° C.

PRESERVATION OF WATER SAMPLES BY SALTING

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ABSTRACT

P. Remlinger, Comp. rend. de la Soc. de Biologie, vol. 70, page 64, 1911, suggests a method of inhibiting the growth of bacteria in samples of water during transportation to the Laboratory by the addition of common salt. In his experiments, ten grammes of sodium chloride were added to one hundred cubic centimeters of water. The flasks so prepared were kept at laboratory temperature and estimations made from day to day. His conclusion was that the salting of a sample of water by the addition of ten per cent. by weight of sodium chloride would prevent any fallacy arising in the bacterial count, provided that the examination was made within forty-eight hours of the collection of the sample.

The importance of this discovery, if true, is at once apparent. Those of us who are constantly engaged in the examination of water transported over considerable distances, know the difficulties of keeping samples properly iced. If we could send out bottles for collection of samples containing a given amount of sterile common salt, and have the sample returned to us without icing, an enormous amount of trouble would be saved, and our results would be much more accurate. It was therefore determined to test the method. Remlinger's plan was followed closely. It seemed good to try other preservatives at the same time. Consequently, duplicate flasks containing resorcin and others containing caffeine were made in a number of cases. Resorcin was used in the strength of two cubic centimeters of a 25 per cent. solution to one hundred cubic centimeters of water. The caffeine was added in the proportion of ten cubic centimeters of an 8.3 per cent. solution of caffeine citrate to one hundred cubic centimeters of water. All were kept at laboratory temperature, plates made from time to time and tests for colon made. We employed samples collected in the ordinary run of business, and samples to which colon was artificially added.

One serious objection to salting, as well as to the other preservatives, was shown at the very beginning, namely: that the growth of colon bacillus is almost invariably inhibited. In only one test out of twenty-eight did we obtain it, although the sample was known to contain colon when the preservative was added. We also find that the bacterial content of the different samples is not acted upon with any degree of uniformity, but varies with the species contained in any given sample. For instance, in one sample of water the count may remain

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practically the same. In the next sample, growth may be almost entirely inhibited. In other words, according to the types of bacteria contained, the action of these preservatives varies tremendously.

Conclusion.—Our conclusion is that neither the salting method proposed by Remlinger, nor the preservation by means of caffeine, or resorcin, has any practical value whatever. We are forced then, for the present, to rely upon refrigeration for preventing changes in samples of water.

SOME LEGAL AND PRACTICAL ASPECTS OF A "BOTTLED MILK" REGULATION

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The Massachusetts Supreme Court has within a few months made an important decision which resulted adversely to the regulation of the Boston Board of Health, requiring the sale of milk in shops in "tightly closed or capped bottles or receptacles" which had been approved by the board. Thus this regulation, which since its inception has been a bone of contention, was nullified after a satisfactory trial of less than one year.

The regulation prohibited the sale at retail of milk or cream in the room or store where the same was put into bottles or other receptacles. In actual practice this involved the purchase of milk by shopkeepers in single package receptacles from milkmen. The authority under which this regulation was adopted was Chapter 75, Section 65 of the Revised Laws, as follows:

"The Board of Health shall examine into all nuisances, sources of filth and causes of sickness within its town, or on board of vessels within the harbor of such town, which may in its opinion be injurious to the public health; shall destroy, remove or prevent the same, as the case may require, and shall make regulations for the public health and safety relative thereto and relative to articles which are capable of containing or conveying infection or contagion, or of creating sickness, which are brought into or conveyed from its town, or into or from any vessel."

This decision, although unsatisfactory from the standpoint of the issue directly involved, is certain to have an important bearing upon regulations of local boards of health in Massachusetts relating to milk as well as to other subjects.

In support of this contention is the opinion of the Supreme Court "that the statute under which the board assumed to act is not broad enough to give them this authority." The Court further states that there is "no power to make general regulations as to conduct or practices injurious to health, which if indulged in by many persons affect the health of the public." Again the Court says, "This statute does not give the board power to make regulations as to all matters affecting the public health." In dealing with this question the Court apparently did not consider the broad general subject of the sale of "loose milk" in shops, but confined itself to the single instance at issue. In the light of the "agreed statement of facts" the Court was of the opinion that "milk kept as this was kept by the defendant was not a 'nuisance, source of filth, or cause of sickness' which gave the board of health jurisdiction to take any action or make any regulation under the R. L. C. 75, s. 65."

This decision has been followed by some criticism of the board for adopting this regulation, i. e., for exceeding its power, and these comments have savored of the theoretic, rather than the practical type. Those who take the board to task should understand that the only feasible plan of determining the legality of a regulation of this kind is to adopt and enforce it. If some aggrieved party

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then desires to contest the question, it may be considered by the courts. In adopting this regulation, however, the legal aspect was not neglected and the board had reason to believe from the opinions secured that it would receive legal sanction. Because of this, and the further belief that the sale of "loose milk" was detrimental to public welfare, the regulation was adopted. It went into effect on June 15, 1910, and had the endorsement of practically the entire community. Its enforcement had been carried on with such success that at the time of the above decision only 0.62 per cent. of the daily supply was being sold in shops contrary to the provisions of the regulation. Furthermore, although the influence upon the public welfare from this change of handling cannot be directly demonstrated, the facts obtainable indicate a decided improvement in the quality of shop milk from both chemical and bacteriological standpoints. Thus there were 27.8 per cent. less court prosecutions based on low standard shop milk (i. e., deficiency in milk solids or fat) from June 15, 1910, to February 1, 1911, than for the corresonding period in 1909-'10. Bacteriologically the gain is more remarkable, for despite the fact that the regulation did not become operative until June 15, 1910, 77.80 per cent. of the shop milk for the year 1910-'11 complied with the board's regulation of 500,000 bacteria per cubic centimeter, while for the year 1909-'10 only 54.74 per cent. of the milk from stores conformed to this standard. With these facts, the wisdom of the board's action in adopting this method for the sale of milk in shops cannot be successfully controverted. The above gain, although anticipated and predicted by its sponsors, fully warrants the outlay of energy in behalf of this regulation and consumers who were benefited by its adoption. Any set-back to the movement for improved milk supplies resulting from this decision can be only temporary, even though it could have been wished that the Supreme Court had been less vague in stating that "we do not consider the question whether this regulation goes beyond the constitutional power of the Legislature to enact as a Statute, or to authorize the board of health to establish locally."

Time has demonstrated the bearing which this decision is to have upon other regulations of local boards of health in Massachusetts. Not only in relation to milk, but to the rules relating to other food stuffs has the decision been applied by the judges of other courts.

For illustration: the past summer has been the first in seven years that no prosecutions have been instituted for violation of the rule of the Boston Board of Health which required all milk intended for sale to have a temperature of not less than fifty degrees Fahrenheit. In the matter of the recently established rule of the Boston Board of Health requiring the covering of food stuffs, it has been found impossible to proceed legally against violators of this order, the opinion prevailing with the judges of the local courts in connection with these subjects, that the legality of these regulations was problematical in view of the important decision above mentioned. This attitude has been upheld within a few weeks by a judge of the Superior Court of Massachusetts, who ruled in a case brought by the Board of Health of Lynn against a dealer for violating its regulation regarding the covering of foods, that the order in question to milk, but to the rules relating to other food stuffs has the decision begn finding of the Supreme Court under the regulation prohibiting the sale of "loose milk" in shops in Boston.

While discussion cannot determine the legality of other regulations of boards of health relating to milk or to other subjects, their attempted enforcement may be followed by adjudications which, whether in support of or against the government's contention, cannot fail in the end to right existing evils. It would appear that practical relief from these complications can only result either by the adoption by the Massachusetts Legislature of laws based upon the regulations of local boards of health, or by the Legislature granting authority to such health boards to make regulations concerning the handling of all foods, independent of the health issue.

A STUDY OF THIRTY-FIVE STRAINS OF STREPTOCOCCI ISOLATED FROM SAMPLES OF MILK

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It is a matter of common knowledge that streptococci are frequently found in samples of market milk and spontaneously soured milk, but there is no agreement in regard to their sanitary significance. Some laboratory workers, notably Slack and Lewis,[1] are of the opinion that the finding of long chains of streptococci in milk is indicative of an inflammatory condition in the udder of one of the cows furnishing the sample. Lewis attaches particular importance to the finding of long chains of streptococci in association with small masses of pus. The writer has had no experience with the latter method but feels certain that the former is unreliable.

Heinemann,[2] who has made an extensive study of this question, came to the conclusion that streptococcus lacticus, which is nearly always found in spontaneously soured milk, can not be differentiated from pathogenic streptococci derived from sources of human infection. He believes, therefore, that no definite conclusions can be drawn from the finding of streptococci in milk.

Jordan[3] makes the statement that "pathogenic streptococci are sometimes present in milk drawn from inflamed udders, but at present there seems to be no sure method of differentiating these from the streptococci found in great abundance in clean soured milk."

Heinemann has pointed out that Bacillus lactis acidi of the Leichmann type is a streptococcus, for which Kruse has proposed the name streptococcus lacticus.

I believe that Heinemann's conclusion is correct in regard to B. lactis acidi being a streptococcus, but I do not believe that this streptococcus lacticus is identical with streptococcus pyogenes.

In 1903, Schottmueller[4] showed that streptococcus pyogenes produces small hemolysing colonies when planted in blood agar plates, whereas the pneumococcus and streptococcus viridans form small green or greenish colonies.

In 1906, I showed[5] that the hemolysing "streptococcus pyogenes" is only occasionally found in normal throats of human beings, but is always found there in tremendous numbers in tonsillitis and scarlet fever. On the other hand, an atypical streptococcus, forming green or greenish colonies in blood agar plates, was found to be a normal inhabitant of the healthy throat.

It has occurred to me, therefore, that it might be possible to differentiate in this way streptococcus lacticus, which commonly occurs in perfectly clean, soured milk from those streptococci which come from inflamed udders and milk ducts. In this study, streptococci were isolated both from market milk, and from samples of fresh milk which had been drawn by the writer into sterilized

[1]Journal of the American Public Health Association, Volume I, November, 1911 p. 778.
[2]Journal of Infectious Diseases, 1906, Volume III, p. 173.
[3]General Bacteriology, Second Edition, 1910, p. 481.
[4]Munich Med. Wchnschr., 1903, I., pp. 849, 909.
[5]Jour. Infect. Dis., 1906, III, p. 755.
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bottles, under aseptic precautions. Streptococci were easily isolated from 8 out of 17 samples of milk that were drawn into sterile bottles, under aseptic precautions. In addition to the cultures isolated from these eight samples of milk, nineteen strains which were isolated from eight samples of milk that had been drawn into an ordinary milk pail were included in this study, making a total of 35 strains.

Nine strains of this lot were found to produce small green colonies on blood agar plates, similar to those chain cocci found in healthy throats. Five of these nine were isolated from market milk and four were isolated from the milk of individual cows, which had been drawn into sterile bottles.

Eighteen strains that were tested produced very minute colonies which usually showed slight traces of hemolysis but often had a greenish tint. These colonies are very different from those of streptococcus pyogenes and are never confused with the latter after they have once been observed. These colonies have also been found in blood agar plates inoculated with material from healthy throats.

Eight of the strains included in this study produced colonies in blood agar plates which cannot be differentiated from colonies of streptococcus pyogenes. Four of these were isolated from the milk of a cow having a deep cut near the base of one teat. Milk spurted freely from this cut when the cow was milked. The cut was made by a barbed wire. Plates made with this milk, which had been drawn into sterile bottles and was used immediately, gave 290 colonies per c. c., more than half of which were streptococcus pyogenes. It is interesting to note here that the milk from one of the teats did not contain streptococci, but only staphylococci. Three of the strains which produced hemolysis were isolated from two samples of market milk. I visited one of these dairies and found there another cow having a cut in a teat, caused by a wire fence. The other dairy I have not had an opportunity to visit thus far.

The ninth strain among these hemolysers was isolated from the milk of an individual cow, which had been drawn into a sterile bottle but without disinfecting the teats and udders. I did not notice anything abnormal about this cow, but did not make a careful examination, neither did I inquire into her history. This work is still in progress and later I hope to get more information about this cow.

Conclusions:

I believe the following conclusions may be drawn from this study at this stage, subject to revision when the work is completed.

Streptococcus lacticus can be differentiated from streptococcus pyogenes by means of blood agar plates. The latter produces small colonies surrounded by a large zone of hemolysis, whereas the former produces green or greenish colonies with little or no hemolysis.

Streptococcus lacticus has no sanitary significance as it is found in nearly all samples of clean, soured and fresh milk, and very often in the healthy milk ducts.

Streptococcus pyogenes seems to occur but rarely in milk and is indicative of the existence of an inflamed condition of the udder of the cow. It seems likely, however, that these organisms may persist for some time after the inflam-

mation has subsided, and that they may occur in mild inflammatory conditions.

It would be interesting to know whether or not streptococcus pyogenes can be found in milk from a healthy cow, if it is drawn by a person having a tonsillitis associated with a cough. Further details about the cultures are given in the accompanying table.

TABLE SHOWING CULTURAL AND MORPHOLOGICAL CHARACTERS OF STREPTOCOCCI ISOLATED FROM FRESH MILK.

Dairy.	Manner of Collecting Milk.	Strains of Streptococcus.	Morphology.	Character of Colonies on Blood-Agar Plates.
Braseth	Drawn into pail.	1	Diplococci and short chains.	Green.
Cochrane ..	" " "	2	Cocci in chains.	Hemolysing.
Green	" " "	3	" " "	"
"	" " "	4	" " "	"
"	Drawn into sterile bottle.	5	" " "	Very minute, faintly hemolysing.
"	" " " "	6	" " "	Green.
"	" " " "	7	" " "	Very minute, faintly hemolysing.
"	" " " "	8	" " "	Green.
"	" " " "	9	" " "	
"	" " " "	10	" " "	Hemolysing.
Hobbs	" " " "	11	" " "	Green.
"	" " " "	12	" " "	Very minute, faintly hemolysing.
"	" " " "	13	Cocci elongated, long chains.	Very minute, faintly hemolysing.
"	" " " "	14	Cocci in chains.	Very minute, faintly hemolysing.
"	" " " "	15	" " "	Very minute, faintly hemolysing.
"	" " " "	16	" " "	Very small, non-hemolysing.
"	" " " "	17	" " "	
"	" " " "	18	" " "	
"	Drawn into pail.	19	" " "	Very minute, faintly hemolysing.
"	" " "	20	" " "	Very minute, faintly hemolysing.
"	" " "	21	" " "	Green.
McD.	" " "	22	Diplococci and	Very minute, faintly
"	" " "	23	short chains.	hemolysing.
"	" " "	24	Diplococci and	Very minute, faintly
"	" " "	25	short chains.	hemolysing.
McV.	Drawn into sterile bottle.	26	Cocci in chains.	Hemolysing.
"	" " " "	27	" " "	"
"	Drawn into pail.	28	" " "	"
	" " "	29	" " "	"
Nelson	" " "	30		Very minute, faintly hemolysing.
"	" " "	31	Diplococci and short chains.	Very minute, green.
Richards ...	" " "	32	Diplococci and short chains.	Green.
" ...	" " "	33	" " "	"
Warren	" " "	34	Short chains.	Green.
"	" " "	35	Cocci in chains.	Very minute, slightly hemolysing.

All cultures when planted upon serum—glucose—agar turned the media white and opaque. According to Libman (Jour. Med. Research, 1901, I, p. 84) this reaction may be used to show that the organisms belong to the streptococci and not to the pneumococci.

THE LABORATORY AS A PROPHYLACTIC MEASURE

JULIO F. ARTEAGA, M.D., Havana, Cuba.

It is no easy matter, in these days of multiple and cheap communication between foreign countries, to maintain a close sanitary watch over all intending immigrants. Yet, it must be admitted that the system established at Hamburg, of keeping under observation until they embark all emigrants that sail from that port, is an ideal one; but we must remember that such a step entails no small expense and probably, not all European nations would be willing to follow the German example.

The usual method of sanitary inspection of passengers, immigrants or others, either at sea-ports or in some small town near the boundary line, is well known to all who have travelled. A rapid survey of each passenger, in some unsuitable building or on board the steamer or railway-car, looking out especially for some signs of eruptive fevers or general weakness, occasionally taking the pulse and rarely, the introduction of a thermometer, is as a rule, the sum total of the average sanitary inspection of passengers.

Who can tell with any degree of certainty that all those passengers so examined, are not sufferers of some latent pathological condition?

In the case of first-class or Pullman-car passengers, that is, persons of the well-to-do class, the danger from future trouble is less than with the poorer class, which usually travels in the steerage. The danger is less, not only because such travellers are more intelligent and know when they should call for medical aid, but also because they have the means of paying for such aid. In the case of the steerage or immigrant class of passengers the reverse is the case. Generally they are stupid and of course, badly off financially. It is for the latter class that measures must be taken, in order to prevent them bringing in diseases to the country where they intend to settle.

Before an immigrant is allowed to enter freely into a country he must first stay for a certain period of time at an immigration depot, where supposedly he is to be studied—physically at least—in order to determine if he be fit for admission.

The medical examination at the immigration stations should be carried out on more thorough lines than heretofore. Formerly it was sufficient to examine for trachoma, leprosy, small-pox or some disease of that sort, but no attempt was made to diagnose latent tuberculosis, quiescent malarial infection, and cholera spirillum—or typhoid bacillus-carrier.

It is here, at these stations, that a well equipped clinical laboratory could render most valuable service. Indeed, it could act as a prophylactic measure. Had it not been for such a laboratory, the health authorities of the State of New York recently would have been at their wits' end, to stamp out cholera.

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Instead, thanks to the laboratory, the passengers infected were correctly diagnosed and the non-infected were allowed to proceed without further molestations.

The routine examination of the immigrants' feces, at least once, might reveal for example, the Eberth bacillus or the ova of uncinaria.

I could quote two cases in my experience, which came under the notice of our Commission for Infectious Diseases, and which, or rather, the failure to do so, illustrate the value of such timely examination, and advisability of the procedure.

One of the cases was that of a young Spanish girl, who a few days after her arrival from Spain, was taken sick. Several erroneous diagnoses were made and of course, faulty treatment given. She was finally taken to "Las Animas" Hospital, and died there. A few minutes before her death the microscope revealed in this patient's excreta, a considerable number of the ova of *ascarides lumbricoides*.

The other case was that of a Spanish laborer, a recently arrived immigrant. A few weeks after his coming, he was brought to "Las Animas" Hospital and died before proper treatment could be given him. Here again, the microscope helped in the diagnosis, because a few hours before the end, the presence of *amoebae* in the excreta were shown microscopically.

I am fully convinced, that had those two cases been subjected to a thorough clinical and laboratory examination at the immigration station, those deaths at least, might have been averted. But in this connection, one point should not be overlooked, and it is, that not only should laboratories be established at quarantine or immigration stations, but they should have proper and efficient employees to carry on the work in the best scientific manner. This is a question that deserves our earnest attention as health officials, because our duty should be to lean more to the prevention of disease, than to lessen mortality and morbidity rates.

All nations take precautions against undesirable immigration, both from the moral as well as, from the physical standpoint. The anarchist, who is considered a moral wreck, because he brings the germs of social discord and dissolution; and the weak immigrant, who is a physical wreck, because he is incapable of having a robust progeny. Both are undesirable. I further hold that the same objection should be raised against those individuals, healthy in appearance, but who are nevertheless physiological wrecks, because laboratory methods have shown, that they carry within themselves pathogenic germs, which are harmful to the community.

NEW METHOD OF SEWAGE SLUDGE TREATMENT

RUDOLPH HERING, D. Sc.

I shall introduce this subject by recalling the fact that the American Public Health Association since its origin has witnessed the advance of sanitation engineering in its various branches to an extent which had not been achieved during centuries before.

The question of water supply at the time of organization of this association, was still surrounded by a great deal of darkness so far as practical guarantees of the results were concerned, but during the last 30 years we have come from a state of uncertainty to one of knowledge. To-day, sanitary engineering is in a condition to predict even what we were incapable of doing only four or five years ago. For instance, last winter in Montreal and Philadelphia was the first one in their history when the usual typhoid rise in the death rate was eliminated. In Montreal since the time when they began to record deaths, there was always a greater number during the winter months. Philadelphia last winter, had still one district that was not supplied by filtered water and there had been the usual increase in the typhoid deaths. But last winter in both cases, the cause was eliminated by disinfecting the water by a minimum dose of hypochlorites, and the usual rise in cases was entirely prevented.

Also with the garbage question, which this association itself took up, good progress has been made. Whereas only 25 years ago this subject was practically in chaos, to-day it is possible to accomplish the desired results of preventing sickness and nuisance by the best works as they are now built and operated.

Before coming to the special subject I was going to speak about, I wish to say that there is another one pertaining to Sanitary Engineering which is coming to the front and which this association will undoubtedly take notice of. I mean the question of ventilation and air supplies, which has not yet reached the stage of precise knowledge, either theoretically or practically. This is about in the same condition as was that of garbage disposal when the association first took hold of it. A great deal of work can be done in that direction and a great deal of doubt and mystery needs to be cleared up. All that is necessary is to get together and earnestly pursue the subject until we have the needed light.

The subject I wished to speak about to-day is an advance made in that branch of sanitary engineering which relates to sewage disposal, namely the treatment of sewage sludge which had not been very satisfactorily solved until within a very few years. Not until quite recently have we been able to say that we can dispose of sludge, so that from beginning to end there need be no nuisance connected with it and in such a way that the disease germs contained in it will presumably be destroyed.

So far as the development of this branch of sanitary engineering is concerned, the first country to take it up was England, because England is a small country with a large population and very small rivers. For 30 to 40 years past, England has been laboring with this question. In the endeavor to find a satis-

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factory solution, sanitary engineering has separated the question into two parts, and not until that was done could we make much headway. In the first place, we should prevent disease and in the second place, we should prevent a nuisance. Not until we could separate the question in this way, could we meet satisfactorily the sanitary dangers.

The best way of eliminating disease germs from sewage is by the use of sand filtration. But there is not enough sand near all cities for the use of this system. We have now, only two cities that have large enough areas of sand, namely, Paris and London. The others must do something else. Now all the large cities on the sea coast or along large rivers naturally put their sewage into the ocean or rivers. This is done because it is found cheapest and if properly done, the nuisance is prevented. But we are not quite sure whether diseases are also prevented, particularly in cases where oysters are raised and food-fish are taken. In general, however, the subject of sewage dilution is to-day considered a safe as well as sanitary means of oxidizing the sewage matter discharged into the same. Precisely the same as the disposal of foul air by dilution in buildings and without, it is a legitimate method of sewage disposal, with the only difference that there is less oxygen available in the water for oxidation than in the air, and that therefore, the process of oxidation will take longer and, due to other reasons, offer more difficulties.

Before much progress could be made in sewage purification, it was found necessary as a fundamental proposition, to separate the sewage into liquids and solids so as to get a more economical solution of the process. Liquid matter can best be purified by oxidation, but not the solids. These must be treated in another way and it is of the treatment of solids that I wish to speak.

This question has always been the bête noir of the whole subject from the fact that the solids were chiefly instrumental in creating the nuisance. Everywhere there was an offensive odor and there seemed to be no way of preventing it. England had tried to do this for over 30 years, and everyone wanted the sewage works as far away as possible, on account of this nuisance.

At last this pressing question has been solved; it was done by the work of Dr. Imhoff in the Essen District of Germany. I have seen a number of the works and there is absolutely no odor about them. The solution of the question has been accomplished by allowing the sludge to settle out of the sewage when passing through a tank, where it was retarded in its flow, sufficiently to allow it to pass through the tanks within one and a half and two and a half hours. This causes the sewage to be practically as fresh when it leaves the tanks as when it enters them.

In order to prevent the rising of gas bubbles within this tank, resulting from the decomposition of the sludge, and passing up through the arriving fresh sewage and, while mixing with it, to prevent loading it with particles of putrescent matter, Dr. Imhoff has suggested a double tank. The upper one is confined to the flowing sewage, and the lower one to the accumulation and rotting out of the sludge.

A narrow horizontal slot at the bottom of the upper tank, which is made of sloping sides, is so arranged that the suspended particles will slip through it into the lower tank, and that the gas bubbles originating in the lower tank

will not rise through the slot, but remain practically in the same compartment which is independently extended by shafts to the surface. The sludge after its thorough decomposition is drawn out at the bottom of the lower chamber and rises automatically to within several feet of the elevation of the surface of the water. It is then allowed to run out and spread over drying beds. The fact that the gas contained in the sludge was under pressure, the gas bubbles thus relieved of the pressure, expand and cause the sludge to become porous and light. This allows it to drain and dry within a few days, whereas it took months for the sludge from the usual tanks to dry. The unstable and non-resistant organic matter has all been converted chiefly into gases and therefore the sludge is practically non-odorous. It closely resembles forest soil.

Within the two tanks, the process of decomposition is confined to the activity of chiefly two classes of bacteria, neither of which produces gases which have any odor. These gases are marsh gas and carbon dioxide, of which the former constitutes about three-quarters, and the latter about one-quarter of the total quantity of gases escaping.

The reason for the prevalence of these two gases is probably due to the extinction of all bacteria producing other foul smelling gases, sulphureted hydrogen being the chief one. This extinction again is due to the fact that the fresh sewage does not flow over the sludge deposit and bring other bacteria of the sewage to it. It seems a question of the survival of the fittest to take possession of the field and not to allow the other forms of bacterial life to gain prominence.

It takes the sludge several months, after starting the works, to get ripe and to have these two species of bacteria prevail. It then takes from two to four months' time for the sludge to be thoroughly decomposed and before it can be drawn off at the bottom.

The tanks are with preference made from 25 to 30 feet deep, not only to cause the compression of the gases which facilitates subsequent drying of the sludge, but also to allow the escaping gases to pass through as deep a mass of the sludge as possible, so as to stir it up. This stirring not only tends to remove the toxins, but to expose fresh surfaces of sludge to the bacteria and thereby to increase the speed of decomposition.

There are now about 30 Imhoff tanks already in existence and in operation in Germany. While at first many doubts were raised concerning the process, these doubts have almost entirely been removed. At the recent hygienic exposition in Dresden, this new process of sludge treatment was practically the only one that was represented and only favorable comments were made by those who had examined the originals in actual operation.

MUNICIPAL INSPECTION OF FOOD SUPPLIES

JAMES O. JORDAN,

Bureau of Milk Inspection, Boston Board of Health.

The supervision of the food supply of Boston by the Board of Health is entrusted to several sub-departments, all responsible to the board. These are known as the Division of Inspection of Provisions; Division of Sanitary Inspection; Dairy Division; Bacteriological Laboratory, and the Bureau of Milk Inspection with its chemical laboratory.

The Division of Inspection of Provisions has oversight of slaughtering establishments (in which no inspectors from the U. S. Bureau of Animal Industry are located), of sausage factories, egg breaking establishments, preserving factories, fish smoking and lobster boiling places, and has general charge of shops where groceries, provisions, fish, fruit and vegetables are sold. The board has authority to seize and condemn diseased and tainted food, and this right is exercised whenever warranted by existing conditions. In addition to this work much consideration is given by this division to the sanitary feature of the various establishments visited. Prosecutions are instituted for the sale of articles unfit for food, and for unclean stores.

The Division of Sanitary Inspection has the sanitary supervision of shops where milk is sold, and upon its reports are based the granting or refusal to issue milk licenses to store dealers by the milk inspector. Bakeries are also inspected by this division, with a view to the installation of improvements in cleanliness, lighting, ventilation, water closets, and drainage. These establishments are whitewashed every three months and a continual supply of hot water must be provided. Ice cream manufacturies and shops where this product is sold are also overseen by this division in an endeavor to compel the provision of better sanitary facilities. In addition to the above many miscellaneous complaints are investigated.

The Dairy Division is charged with the supervision of all farms where milk is produced, also of all places where milk is handled (exclusive of stores), and stored for subsequent sale within the city.

The Bacteriological Laboratory makes examinations of miscellaneous food materials received from other divisions, such as milk, ice cream, butter, eggs and meats.

To the Bureau of Milk Inspection is entrusted the execution of laws relating to milk, butter, oleomargarine and vinegar. The regulations of the board which deal with the quality of milk and ice cream are enforced by this division. In the chemical laboratory examinations of the above products are made, and in addition a limited number of investigations of foods, such as fish, meats, fruits, ice cream cones, etc., submitted by other sub-departments.

Without entering into details concerning the results which have attended this work, as carried on under the direction of the Boston Board of Health in the various divisions, it can be stated that what successes have been achieved

Read before the Municipal Health Officers' Section, American Public Health Association, Havana, Cuba, December, 1910.

can be attributed to the definite policy pursued, namely, that of, first, inspections; second, laboratory examinations; third, education; and fourth, prosecutions. For the inspection service records are kept either by filing cards, score cards, or similar devices, and follow-up systems with subsequent re-inspections are employed in the endeavor to correct faulty conditions. Speaking generally, it can be stated that this plan has and is yielding pronounced improvement. The basic principles for laboratory work are betterment of quality of foods from the health standpoint and lessening of opportunities for the purveyor of fraudulent products. For the educational propaganda, circulars, cards, notices, letters, interviews and personal advice during inspection trips are utilized to the greatest extent. Whenever opportunity offers exhibits are made which illustrate and place before the public the extent and necessity for the work which the board is pursuing. In these endeavors, object lessons, photographs and printed matter play no inconsiderable part. Lectures and talks are also given, but to a limited extent. Prosecutions are rarely instituted for faulty sanitary conditions, unless there is proof that no other means will yield the desired results. In all instances an endeavor is made to bring the regulations of the board to the attention of the interested individuals. Prosecution, however, invariably follows the serious infringement of laws like those relating to milk products, and the instituting of 470 cases in a single year by the Bureau of Milk Inspection, with fines aggregating $6,075.40, gives an idea of the extent of this work.

While the efforts of these divisions have been followed by marked improvement, the extent of this gain would have been more pronounced under conditions which would lead to strict compliance with the promulgations of the Board of Health. The chief difficulty has been that of lack of authority to enforce demands. At the present time the legality of many of the regulations of local boards of health in Massachusetts are in serious doubt. This is a state of affairs which renders effective work impossible and unsatisfactory, and should be immediately corrected.

As an outcome of Boston's experiences in municipal food inspection, the following conclusions and comments are submitted for the more efficient handling of those problems over which boards of health are ordinarily supposed to have supreme control.

1. It is suggested that all restaurants, ice cream plants, sausage factories, egg breaking, preserving, fish smoking, and lobster boiling establishments be licensed by boards of health, with authority to frame rules for the government of the above places, as well as to revoke said licenses.

2. That boards of health have authority to prohibit the exposure of certain foods; to require that all stores where foods are sold shall have proper lavatory facilities; and that no store where articles of food are sold or prepared shall be used for domestic purposes, or open directly into living rooms, and that the water closets in such stores shall be properly located.

3. At the present time inspected and stamped meats, as well as uninspected and unstamped meats are on sale in Boston. To obviate this unsatisfactory condition, it is recommended that all animals be inspected at the time of slaughter by a competent and officially appointed authority and the carcasses properly stamped.

4. The Massachusetts law requires calves to be four weeks old and to weigh forty pounds before slaughtering. As the laws of different States vary materially in this respect, and as the principle of arbitrarily fixing by legislation the time when veal becomes a suitable food is a mooted question, this subject if it is to continue to be governed by legal measures, should at least be controlled by a uniform law. Such law, regardless of whether it is based on age or weight, should require the carcasses of all calves which are to be employed as food to be free from disease.

5. Inspectors of milk issue milk licenses, and have the right to refuse them to persons not deemed "suitable" to deal in this product, but a license once granted cannot be revoked, even if the holder should later be considered unsuitable to continue to handle this commodity. Authority for such revocations should, however, be vested in inspectors of milk or boards of health; this power of revocation being deemed of more importance than the right of refusal.

6. Dairy inspection by some State authority appears desirable in place of local inspection. This plan would prevent duplication and lessen expense, as well as friction with producers, which is likely to follow inspections by more than one agency.

7. The hygienic and sanitary oversight of the production of milk should relate not only to the use of this commodity as milk, but also when utilized as cream, butter, cheese, or as food in any other form. Such control should include the licensing or issuance of permits to producers, with power to revoke for cause said permits.

I desire to thank Dr. Samuel H. Durgin, chairman of the Board of Health, Dr. P. H. Mullowney, Health Commissioner, Dr. Alexander Burr, in charge of the Division of Inspection of Provisions, and Mr. Thomas Jordan, in charge of the Division of Sanitary Inspection, for assistance and suggestions in the preparation of this paper.

REPORT OF THE COMMITTEE ON THE STUDY AND PREVENTION OF COMMUNICABLE DISEASES

Owing to the unexpected resignation of Dr. W. A. Evans, the Chairman, and the consequent confusion entailed at the last moment, your committee is unable to present a full report.

Dr. Evans assigned work upon different diseases to different members of the committee, but much of the material was received too late to be available and in many instances it has been impossible to do more than make a very imperfect compilation of the facts.

For these reasons it seemed best to confine the report to a very short resumé of some of the more important work which has been done in the investigation of methods of prevention of communicable disease during the past few years.

Your committee offers no suggestions in regard to the value of terminal room disinfection as a means of prevention, as it is understood that another committee has this question under consideration, and it is useless to duplicate work. For the same reason nothing has been said in regard to anterior poliomyelitis and many other diseases.

With this explanation your committee presents its report.

GENERAL CONSIDERATIONS IN REGARD TO PREVENTING THE SPREAD OF INFECTION.

The first necessity in the attempt to control the spread of infection is a knowledge of how it is spread.

In general there are three theories in regard to the manner in which infection is transmitted; these are, by means of the air, by means of contact and by means of fomites.

The results in controlling infection in those hospitals where cases of different communicable diseases are treated in the same ward separated only by a screen or a barrier of tape, or in the so-called cubicles, seem to show that infection is transmitted by means of contact rather than through the air.

By "contact infection" is meant the transmission of infection by means of a person or article which has been very recently in contact with the patient or his fresh discharges, as well as by direct contact with the patient himself, by kissing, etc.

In all these hospitals what may be called "aseptic nursing" is practiced, and the same nurse cares for cases of different diseases, taking certain precautions to prevent the spread of infection by contact.

The work is just beginning in the United States and Germany, but in England and France there are a number of such hospitals.

The results are noteworthy. In the North Eastern Hospital in London, a cubicle hospital, during two years only 16 cases of cross infection developed among 1,290 patients.

Read before the Municipal Health Officers' Section, American Public Health Association, Havana, Cuba, December, 1911.

In the South Western Hospital, a cubicle hospital, during 18 months 20 cases of cross infection developed among 704 patients.

In the Plaistow Hospital, where both the cubicle and barrier systems are used, there has been no case of cross infection in three years among the cubicle patients. No figures are yet available for the barrier work.

In the United States in the Providence City Hospital, Providence, R. I., built under the supervision of Dr. Charles V. Chapin, Superintendent of Health, and a member of this association, a hospital where the separate room and the barrier systems are both employed, the figures for 18 months ending September 1, 1911, show that 7 cases of cross infection developed among 365 patients in the rooms. In this hospital the rooms open onto a common corridor and the doors are always open, the nurses going from case to case. No disinfecting solutions are used for the hands.

These figures, which show fewer cases of cross infection than in many isolation hospitals conducted under the old system, make strong evidence against the theory of air borne infection.

By transmission of infection by means of fomites is meant its spread by means of articles which retain the infection for a considerable period of time.

Many facts go to disprove this theory: thus in yellow fever, increased knowledge has taught that it is not transmitted by fomites as was formerly universally believed, and the same is true of many other diseases.

In still other diseases, as typhoid fever and diphtheria, infection which was formerly believed to be due to fomites is now known to be due to carrier cases, that is, to contact infection.

It is by carrier cases also that many facts in regard to the apparent failure of isolation to prevent infection, can be explained.

It has been shown that prompt isolation and removal to a hospital of cases does not necessarily reduce the percentage of incidence, as was expected. In fact, in some cities where removals to a hospital reached as high as 60 per cent. of all cases reported, the percentage of incidence remained high; in some instances higher than in cities where the percentage of removals was much lower, and the disease was by no means stamped out.

In spite of this, isolation must remain for the present the chief means of control, and indeed in certain instances, isolation is of great value. When a disease suddenly appears in a community from which it has been long absent, prompt isolation of cases has a marked influence in controlling its spread and should be carried out rigidly. In such communities the number of carriers is small, and the main sources of infection are the patients themselves, but where a disease has been present for a long time, carriers must be numerous and for this reason, isolation does not have such a marked effect in controlling the spread of infection.

It appears then that the chief means of spreading infection is not through the air or by means of fomites, but by means of contact either with carriers or the patients themselves.

It is also impracticable to prevent the spread of infection by means of carriers owing to the impossibility of restraining such cases.

Typhoid Fever.

Little can be done in preventing the occurrence of typhoid by isolation of the sick, on account of its spread by means of carriers, but the use of anti-typhoid vaccination has shown its value in this work. While the use of protective vaccination by means of the injection of living bacilli is theoretically of great value, there are certain objections to its use. One question which has arisen is whether the injection of living bacilli might not turn the subject into a carrier. As injection with vaccines from dead bacilli or of bacillary extracts is not open to such an objection, the former is the best to use at the present time. A clear statement of the present status of anti-typhoid vaccination is to be found in the report of the commission appointed by the Academy of Medicine of Paris.

A brief summary of its conclusions is as follows:

The results of anti-typhoid vaccination are such that it should be urged upon all who are likely to be exposed to infection.

Its benefits are shown by the fact that a comparison between those who are protected by vaccination and those who are not, shows that case incidence in the former is at least one-half that in the latter. Those among the vaccinated who contract typhoid have much milder attacks than the unvaccinated and moreover the case fatality among the former is one-half that among the latter.

The immunity conferred appears to last from one to four years. Anti-typhoid inoculation is without danger to the subject.

The inoculation is followed by a period of greater susceptibility to infection; a period which may last from one to three weeks. For this reason inoculated persons should take especial care against exposure to infection during this period, and it is unwise to allow persons to take the inoculation during an epidemic when there is greater danger of infection.

The inoculation should not be given to a person who is apparently incubating typhoid, or at the beginning of an attack. The subject should preferably be healthy and free from organic or chronic disease, especially tuberculosis.

One practical fact connected with anti-typhoid vaccination should not be forgotten, and that is that persons who have been immunized in this way, carry a positive Widal, a fact which may be of importance in future diagnosis on the subject. It is well to ask if your patient has previously taken an anti-typhoid vaccination.

At present anti-typhoid vaccination must be voluntary and it is suggested that health officers urge physicians to recommend its use among their patients.

Measles.

Little has been accomplished towards the control of this disease. Measles is one of the most difficult of the commoner diseases of childhood to control on account of its great infectiousness and for the reason that parents pay little attention to protecting their children from its attacks, believing that it is a necessary evil of childhood, and that the sooner a child has it and is done with it the better for all concerned. Education of parents has little or no effect, nor does it seem to affect its spread whether patients are strictly isolated or simply excluded from school without isolation.

In a recent article Dr. R. Davison, Medical Officer of Health, Maldens and Coombe, urban district in England, gives his experience with measles during 15 years.

It is the custom to close the schools promptly at the outbreak of an epidemic; to instruct the teachers in regard to the dangers of the disease and of the necessity of reporting all cases at once; to send a leaflet of instructions to every family where a case occurs and to disinfect with formalin the school and every house where a case occurs.

His conclusions are that:

Instruction of the teacher has no effect in controlling its spread. Closing the schools has no effect in controlling its spread. Disinfection has no effect in controlling its spread. Notification is of value in leading the inspectors early to the locality where the disease exists and getting the cases under treatment early and so lessening the case fatality.

Scarlet Fever.

An attempt was made to learn if there was any uniform procedure among health officers in regard to scarlet fever, and with this object in view a circular letter was sent to 143 cities in Canada and the United States asking for information. Eighty-seven replies were received from health officers to whom 52,620 cases of scarlet fever were reported during 1910. It would take too long to give an analysis of all the points covered by the replies but a few are of interest.

Sixty-four cities have a minimum period of quarantine which varies from 10 days to six weeks. In 39 cities all the members of the family are segregated during the continuance of the disease, and in 81 the well children are excluded from school as long as the patient is ill and for a varying period after recovery.

All cities that replied placard the house during the continuance of the disease and 77 require a more or less rigid isolation of the patient in a separate room. However, only 59 make inspection to see if the requirements of the board of health are obeyed, while six rely upon reports of neighbors, and 22 make no attempt at inspection. In 50 cities the board of health inspects the patient after the report of recovery, before release, while the remainder rely on the report of the family physician. The cessation of desquamation is the sign of readiness for release in 59 cities, although 56 pay some attention to the condition of the nose and throat.

Only four will release a patient when nose and throat appear normal, paying no attention to desquamation, and 11 will release when desquamation has ceased even though a nasal discharge exists.

Terminal room disinfection is compulsory in 83 cities and in 78 of these it must be done by the Board of Health.

In all but three where disinfection is compulsory, some form of formaldehyde, either liquid or solid, is used. Of the exceptions one uses chlorine gas, one sulphur, and one cleans with a solution of bichloride of mercury, strength not stated.

The amount of disinfectant used per 1,000 cu. ft. varies from 6 to 32 oz. of the liquid forms, the majority using 16 oz. or under, and from 1 to 2 oz. of the solid form; the room being closed from 6 to 48 hours.

Fifty-one health officers believe that infection is carried by scales of desquamation, 19 are doubtful and 13 do not so believe. Thirty-eight believe that infection is carried by fomites, 16 are doubtful and 29 do not so believe. Four did not reply to either question.

The question of where the infective principle resides, whether in the scales of desquamation or in the nasal and buccal discharges, is still an open one although an increasing number of observers believe that it resides in the latter rather than the former.

In England, where more work of this kind seems to have been done, it has been found that, by discharging patients when the throat and nose appear normal, without regard to desquamation, the average stay in hospital was reduced from 45 to 29 plus days without any increase in the percentage of return cases.

Observations in this country seem to show that patients with a nasal discharge but free from desquamation invariably cause return cases soon after release, while patients who are desquamating but free from nasal discharge do not so cause return cases.

Not much work on immunization against scarlet fever has been done in this country but the figures from Russia seem to show a diminution of case incidence among immunized patients amounting to about one-half that among the non-immunized. In this country the results in the Chicago Contagious Disease Hospital, as reported by Dr. Biwer at the Milwaukee meeting in 1910, were such as to encourage a continuance. No figures are yet available for later work. The immunity appears to last about three months. Other observers report a diminution of case fatality of one-half among patients with scarlet fever, treated with streptococcus vaccines.

Your committee would suggest further observations of the value of streptococcus vaccine in the treatment of and immunization against scarlet fever.

It is also suggested that further observations be made upon the question of the transmission of infection in scarlet fever, whether by the scales of desquamation or by the nasal and buccal discharges. This may be done by making a careful study of all instances of return cases and learning whether the infecting case was desquamating or had a nasal discharge or both, and also whether it developed a "cold" shortly before the illness of the return case.

FRANCIS GEORGE CURTIS, M.D.,
Acting Chairman.

THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH, BOSTON, MASS., ANNUAL MEETING

(Abstract of Proceedings.)

The annual meeting of the Massachusetts Association of Boards of Health was held at the Hotel Brunswick, Boston, Thursday, January 25, 1912, with Vice-President Samuel H. Durgin presiding.

The following lists of applicants for membership approved by the Executive Committee were elected to membership in the Association: Dr. George L. Jones, Wellesley; Dr. Thomas H. Sanders, Webster; Dr. Patrick H. Mullowney, Boston; Dr. James J. Gallivan, Boston; Prof. George C. Whipple, Harvard University.

REPORT OF TREASURER FOR 1911.

Receipts

Balance from 1910	$1,380.32
Annual assessments	559.00
Interest	26.78
Total receipts	$1,966.10

Expenses

Subscriptions to Journal A. P. H. A.	$231.75
Reporting meetings, etc.	110.99
Clerical assistance to Secretary and Treasurer	17.50
Printing for Secretary and Treasurer	78.37
Printing for committees	9.25
Cigars and lunches	38.40
Treasurer's bond	4.00
Total expenses	$490.26
Balance in hands of Treasurer	1,475.84
Total	$1,966.10

Of this balance $1,000 is in the West Newton Savings Bank, drawing interest.

Respectfully submitted,

FRANCIS GEO. CURTIS, *Treasurer.*

Dr. CURTIS. I might say, that owing to the change last year in the annual dues, by which half was for payment of the subscription to the Journal and half for the annual dues, we shall have rather a smaller balance this year than we should have, because many men, who rather delayed in paying their annual assessments, received numbers of the Journal and then afterwards decided they didn't wish the Journal because they got it in other ways. So that we have

carried quite a number of unnecessary subscriptions to the Journal. I would ask this year that gentlemen who do not wish to subscribe for the Journal would let the Treasurer know at the earliest moment, so that the list can be revised.

(On motion, the report of the Treasurer was received and placed on file.)

Pending Legislation

Dr. Curtis of Newton drew the attention of the association to House Bill 840, entitled, "An Act to Provide for Uniform Regulation of Diseases Dangerous to Public Health," and House Bill 841, entitled, "An Act to Provide for the Reorganization of the State Board of Health and to Prevent the Spread of Disease." After considerable discussion in which Drs. Stevens, Kennedy, Voss, Curtis, Barnes, Dionne, Durgin, Washburn, Messrs. Bolling, Packard and Kirshbaum took part, a motion by Dr. Curtis to the effect that the association go on record as opposed to these bills, was carried.

Mr. Newcomb of Salem made a motion that the association approve of House Bill 627, entitled "An Act Relative to the Exposure of Food Stuff to Insects and Animals." The motion was seconded and carried.

Mr. Coffey of Worcester made a motion that the association put itself on record as opposed to House Bill 843, entitled "An Act Relative to Appeals from the Decision of Boards of Health of Cities and Towns." The motion was seconded and carried.

Dr. Washburn moved that the chair appoint a committee of three to act as a Legislative Committee of the Association. The motion was seconded and carried.

Committee Reports.

Mr. BOLLING. The Committee on Milk Legislation desires to report that as directed at the last meeting we have introduced at the present session of the Legislature a bill somewhat similar to House Bill 350 of last year. The present bill is Senate Bill 141.

Dr. PALMER. I wish, briefly and verbally, to make a report from the Committee on Sex Hygiene of this Association. I regret that it is verbal, but it must be because our Secretary, Mr. Kreusi, has permanently removed from the city, and Dr. Chase of Brookline, who was to report in his place, is not present.

I will state briefly that this committee has attended to its business in a legitimate way. We have not made very much noise in doing it, but we have been accomplishing something. Our work has been chiefly through the issue of the pamphlets which I presume are familiar to you all. These leaflets or pamphlets are being inquired for in a great many places, and permission is asked for by other associations and boards of health for leave to print them in their own sections. Owing to the removal of Mr. Kreusi our headquarters for these leaflets at the present time is at 7 Hancock Avenue, under the jurisdiction of the State branch of the American Federation for Sex Education and Hygiene. Mr. Burtwell is the secretary of that committee. Your committee also, as they have had opportunity, have lectured on sex hygiene before such organizations as they could get a hearing before—such organizations as labor unions and women's clubs, and schools and colleges. I think I can say truthfully that the time never

has been when there has been such willingness and eagerness to hear a proper statement of this tremendous question, put in a proper light. The people are wide awake, and I only hope to see the time come when venereal diseases will be required to be reported by physicians just as we report other dangerous and contagious diseases at present. The leaflets have also been reprinted in several different languages by the Rhode Island State Board of Health through Dr. Swarts, its secretary. I think that we have been accomplishing the object for which the committee was appointed If the work of the committee has met with approval of this association we respectfully ask that it may be continued along the line of its present endeavors. At first we had money from this association to print these leaflets but owing to our straightened financial situation that money has been cut off and it is now done by private subscription. In Rhode Island it is done under the auspices of the State Board of Health, and it seems to me it would be eminently fitting and wise for our own State to distribute these circulars as well as other information on other dangerous diseases.

It was moved and seconded the report be accepted as progressive and the committee continued. The motion was carried.

Papers Presented.

The following papers were then read:

The Prevention of Infant Mortality by Breast Feeding—Wm. H. Davis, M.D.

The Chemical Disinfection of Sewage—Professor Earle B. Phelps.

The Sanitary Regulation of the Oyster Industry—Professor F. P. Gorham.

(These papers and the discussion which followed will be found printed elsewhere in this copy of the Journal.)

Election of Officers.

The following gentlemen were elected officers for the ensuing year:

President—Henry P. Walcott, M.D.

Vice-Presidents—Samuel H. Durgin, M.D.; C. V. Chapin, M.D.

Secretary—James C. Coffey.

Treasurer—Francis G. Curtis, M.D.

Executive Committee—L. M. Palmer, M.D., South Framingham; F. G. Wheatley, M.D., North Abington; John F. Worcester, M.D., Dorchester; J. J. Goodman, M.D., Clinton; F. W. Taylor, M.D., Cambridge.

Dr. Denny moved that the chair appoint a committee of three to consider the question of changing the method of nominating officers. The motion was seconded and carried.

PUBLIC HEALTH NOTES

New York Academy of Medicine

The Public Health, Hospital and Budget Commitee of the New York Academy of Medicine has outlined a program to be followed out which is of such scope that it should have a very important effect on improving the public health and hospital conditions of that city. The following are the more important purposes of the Committee:

I. Public Health.

a. To maintain a bureau for the collection of facts in regard to public health, sanitation and hygiene.

b. To endeavor to establish an active cooperation with all public health activities in the city.

c. To keep the medical profession advised of current public health conditions.

d. To render to the public authorities and to the community at large an authoritative medical opinion on public health matters. This is to include frequent conferences with officials of various city departments, the holding of public meetings, the giving of lectures, the distribution of literature, and other methods of publicity.

e. To undertake and suggest special researches looking to the solution of vital public health problems, such as an investigation of industrial diseases, etc.

f. To make a comparative study of methods and results of public health activities in other cities, both in this country and abroad.

II. Municipal Budget.

a. To utilize facts obtained by the study of public health and hospital conditions for practical application in the preparation of the annual municipal budget.

b. To assist actively the various departments of the city government which relate to public health and hospitals in the preparation of their tentative budgets.

c. To take active part in the budget hearings before the Board of Estimate and Apportionment.

III. Hospitals.

a. A study of hospital and dispensary conditions in New York City, including public and private institutions in all the boroughs. This study to be made from a standpoint of: (1) Construction; (2) Equipment; (3) Administration; (4) Medical efficiency.

b. To plan for the future development of hospitals and dispensaries according to the distribution of population and to further the efforts already being made to raise the standards of dispensary work.

c. To undertake a comparative study of hospitals and dispensary conditions in other cities, both in this country and abroad.

A gift from Mrs. E. H. Harriman has made it possible to carry on the investigation in a thorough manner. Dr. E. H. Corwin is to direct the work of the committee.

Rural Tuberculosis

Tuberculosis is frequently called a city disease, and much of the work of anti-tuberculosis associations has been carried on in the more populous places. A very careful study of rural tuberculosis has recently been made by the Wisconsin Anti-Tuberculosis Association. (The Crusader, Wisconsin Anti-Tuberculosis Association, February, 1912.) This organization, recognized as being one of the most progressive of its kind in the United States, has made an intensive study of tuberculosis in Dunn County, Wisconsin. This county was chosen for the investigation because it presented a fair type of Wisconsin agricultural county in which the death rate from tuberculosis is not out of proportion to that of the State at large. Conditions in this county were considered to be representative of the agricultural counties of the State.

The tuberculosis rate of the county as a whole was found to be remarkably stationary during the decade which was studied (1901-1911). It was demonstrated, however, that the rate had decreased markedly during this period in the city of Menominie (the only city in the county) but had correspondingly increased in the rural sections.

The investigators discovered that the city had slightly less house overcrowding than was the case in the country. The houses in the country were, however, found to be cleaner, but the ventilation to be much inferior. "Indeed, the deep seated superstitious fear of 'night air' is nowhere so generally embraced or so vigorously or un-

blushingly proclaimed." Lack of reporting cases by physicians to the local health authorities was noted. Not a single case was found to be reported, although this was made mandatory by the Wisconsin statute of 1907.

Disinfection of infected premises on vacation or death of the patient was found also to be rarely practiced. A number of cases are cited where the inference is that persons contracted the disease by occupying houses which had been previously occupied by consumptives but never disinfected. The common drinking cup is indicated as being more prevalent and dangerous in the rural districts than in the city, where there is an abundance of running water. In the former it takes the form of a dipper in the pail, which constitutes the water supply of the house.

The report points out that ignorance, lack of laws of sanitation and inefficient administration of public health precautions, combined with ignorance and incompetence on the part of a considerable percentage of physicians, contribute to bring about the serious condition which exists. The following is the concluding paragraph to this extremely valuable study:

"Whatever programme is employed in the solution of the rural problem, be it the establishment of local hospitals for advanced cases, sanatoria for the care of early cases, medical inspection of school children, common school instruction in hygiene, the reorganization of health departments with employment of inspectors, visiting nurses, lecturers and exhibits, it must be comprehensive enough to take into account every resident regardless of how far removed he may be from congested community life."

As far as we know, this is the first study of this kind that has been made in the United States, and great credit is due the Wisconsin Anti-Tuberculosis Association. The difficulties in obtaining the necessary data were considerable and entailed much hardship on the part of the investigators.

As another phase of the work of this organization it might be mentioned that largely through its efforts $153,666 have been appropriated by State, counties and cities for tuberculosis purposes since last June (six months).

Mosquito Campaign of Montclair, N. J.

"A campaign against mosquitoes is proposed by the Board of Health of Montclair, N. J. An appropriation of $2,000 to conduct the work during the summer of 1912 has been requested of and granted by the town council. The plan as thus far outlined is to employ a sufficient number of inspectors to cover the whole town in detail for the purpose of detecting and eliminating all breeding places. During the unusually dry summer of 1911, when it would normally be expected that mosquitoes would be few, they were unusually prevalent. This was attributed in part to the fact that the low water in the numerous brooks flowing through the town resulted in many scores of stagnate pools in which mosquitoes bred freely until they were discovered and breeding stopped."—Engineering News, Feb. 8, 1912.

Smoke Abatement

"The International Coal Smoke Abatement Exhibition is to be held in the Royal Agricultural Hall, Islington, London, England, from March 23 to April 4, 1912. Exhibits will be classified under smokeless fuels, domestic heating, other heating, various types of furnaces for industrial plants, testing appliances, fans and ventilating apparatus, and devices to prevent the emission of dust or dirt from chimneys. The exhibition will be held under the auspices of the Coal Smoke Abatement Society."—Engineering News, Feb. 8, 1912.

National Board of Health of Venezuela

In view of the interest regarding the establishment of a National Board of Health in the United States, the following, taken from the Bulletin of the Public and Marine Hospital Service of Jan. 5, 1912, is not without interest.

By an executive order of Gen. J. V. Gomez, President of the United States of Venezuela, of Nov. 13, 1911—a National Board of Health is established. The reason for the establishment of this national board as stated in the decree may be summarized as follows:

1. Sanitary measures to be effected, "must be established with perfect scientific rigor and practice, and in a regular way, stable and uniform throughout the country."

2. The need for better sanitary conditions, not only for the internal development of the republic, but for the fostering of foreign relations.

Royal Institute of Public Health

It is interesting to note that the next meeting of the Royal Institute of Public Health of England is to be held in July in Berlin, Germany. By such procedure mutual benefits should be derived by both nations. Public health work is indeed world-wide, and the discoveries and experiences of one nation, which will be valuable to others, are freely and willingly given.

Sanitary Engineering Section, A. P. H. A.

The Section on Sanitary Engineering of the American Public Health Association was successfully organized at a meeting held in New York on January 19, 1912. The constitution of the Section was adopted and the following gentlemen were elected:

Chairman, Mr. Rudolph Hering; vice-chairman, Col. J. L. Ludlow; secretary, Dr. H. D. Pease; recorder, Prof. Geo. C. Whipple. Members of the Council, Mr. Andrew J. Provist, Jr., Mr. F. A. Barbour, Mr. Langdon Pearse, Mr. Wm. Paul Gerhard, Mr. Frederic H. Bass.

The constitution provides for the appointment of Technical Committees by the Council of the Section. These committees shall embrace the sanitary engineering aspects of the following subjects, among others: Air supplies, water supplies, sewage collection and disposal, refuse collection and disposal, and such committees as are to report annually to the Section.

The qualifications for membership in this section as given in the constitution are as follows: "There shall be but one class of membership, the active. Sanitary engineers in the active practice of their profession, and other members of the American Public Health Association having or having had professional relation to the technical aspects of Sanitary Engineering, are eligible for membership in this section."

The introduction of this Section into the association is most important and will strengthen the association in many ways. Its advent has been most auspicious and great success is predicted for it. Members of the association with the necessary qualifications who wish to affiliate with the Section are invited to send their names to the secretary, Dr. H. D. Pease, 39-41 West 38th street, New York City.

Vegetables and Typhoid Fever

A recent number of Public Health Reports (Vol. XXVII, No. 6) contains a short article on "Vegetables as a Possible Factor in the Dissemination of Typhoid Fever," by R. H. Creel, in the Public Health and Marine Hospital Service. Dr. Creel refers to the previous work, showing the viability of the typhoid bacillus in soil, and comments upon the great variability of results obtained by different workers, and then suggests the possibility of uncooked foodstuffs, such as fruits and vegetables, as a means of conveying infections acquired at the time of cultivation to the consumer of such raw foods.

As no data are available on the subject, experiments were undertaken by the author to determine the possibility of this means of infection, and to test the viability of the typhoid bacillus on garden truck. Lettuce and radishes were the vegetables used in these experiments, which were carried on during a period from December, 1910, to April, 1911. The soil was inoculated with an emulsion of fecal material to which a 24-hour agar culture of bacillus typhosus was added, and subsequent treatment of the soil was by sprinkling to simulate rain.

Tests of the plants after the isolations of the typhoid bacillus were made, using Endo's medium and mannite litmus agar as culture media. The stems and leaves of the plants were the portions taken for the examination in order to avoid the sub-surface portion which might very easily be infected by adherent soil. In some instances the portions of the plants were washed with sterile broth and plated directly, while in other experiments the leaves and stems were rubbed directly on the plated medium. The examination of the developing colonies of characteristic appearance was carried out by planting in broth tubes and then incubating. After 24 hours a drop of highly agglutinative serum was added. If agglutination occurred the culture was replated and the resulting growth studied on different media. Confirmation was considered complete if the organism was a motile bacillus agglutinating in high dilutions, not liquefying gelatin, producing an acidity in milk not exceeding that caused by a known typhoid control, giving a negative indol test, and forming no

gas on lactose broth.

The results of the experiments showed that on plants cultivated indoors the typhoid bacilli could be recovered after 25 days, on plants cultivated in the open air and exposed to rain and sunlight during part of the day, the leaves and stems showed typhoid bacilli after 31 days. Plants cultivated in the open air and exposed to sunlight throughout the entire day and to rainfall showed the presence of typhoid bacilli after 10 days.

Further experiments showed that the organisms adhere to the plant with a considerable degree of tenacity.

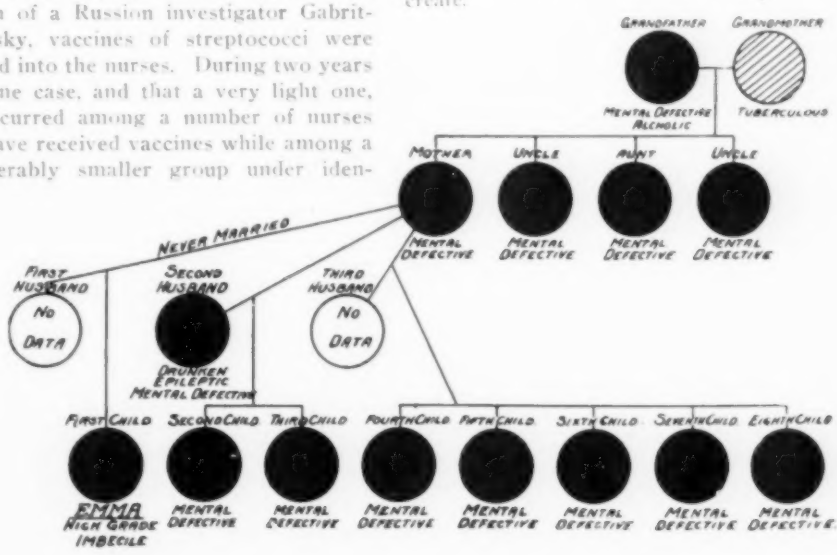
The conclusion to be drawn from this work is that vegetables, such as lettuce and radishes, if grown in infected soil, may serve as carriers for the disease germs though the plants themselves appear to be washed free from organisms, and the latter may endure for at least 31 days under some conditions, a period sufficiently long for some varieties of lettuce and radishes to mature. It is obvious, therefore, that the greatest care should be taken in the treatment of soils used for the production of such foods and in the cleansing of such foods for table use.

Scarlet Fever Prophylaxis

Dr. W. H. Watters gives the results of his experiences in immunizing nurses who have to attend scarlet fever cases. (Journal of the American Medical Association, Vol. LVIII No. 8.) Following the suggestion of a Russion investigator Gabritschewsky, vaccines of streptococci were injected into the nurses. During two years "but one case, and that a very light one, has occurred among a number of nurses who have received vaccines while among a considerably smaller group under identical conditions and environment (but not immunized), five times as many cases have occurred, and those not particularly light." Dr. Watters realizes "that it would be folly to attempt to draw any conclusions" from the small number of cases studied (36 nurses, 21 of whom were immmunized and 15 not vaccinated) but points out that the results are suggestive.

The Right of Birth

An important symposium on "The Right to be Well-Born" appears in the Survey for March 2nd, 1912. Papers are contributed by Prof. Edward T. Devine, Franklin B. Kirkbride, Eleanor H. Johnson, Charles B. Davenport, Ph.D., Max G. Schlapp, M.D., Katherine B. Davis, Henry H. Godard, Ph.D., L. Pierce Clarke, M.D., Elizabeth S. Kite, Edward R. Johnstone and Charles S. Little, M.D. Various aspects of the relation between feeble-mindedness and general welfare are presented in a very telling and interest-compelling manner. It is pointed out that the greatest need of all is for more institutional care. As Dr. Devine states: "Biology and economics unite in demanding that the strains of feeble-mindedness shall be eliminated by the humane segregation of the mentally defective." The accompanying hereditary chart is reproduced to show graphically how the lack of proper institutional care of defectives may lead to the production of a large number of individuals who are feeble-minded and unfit to procreate.



Diphtheria Bacilli Carriers

Health officers are familiar with those cases of diphtheria which persist in giving positive cultures of Klebs-Loeffler bacilli for long periods. Anything which will aid in ridding the throat and nose of these organisms is to be looked upon as of great practical value. In 1909 Schiötz reported that in a number of cases of chronic carriers of diphtheria bacilli, he was able to rapidly eliminate the organisms by treating the throat and nose with cultures of Staphylococcus aureus. Dr. Lydia M. DeWitt has carried on further experiments in this subject the results of which are published in the Journal of Infectious Diseases for February. As a result of these investigations Dr. DeWitt concludes that it seems "advisable and effective to treat slowly convalescing diphtheria cases and diphtheria carriers with Staphylococcus aureus culture." She, however, cautions against the use of this method before the mucous membrane of the throat has become intact on account of the danger of invasion of the deeper tissues by these pyogenic bacteria. Two negative cultures are not always to be considered sufficient before discharging the patient after this treatment, as there may be a reappearance of the diphtheria bacilli. Dr. DeWitt's experiments show that the reason "for the apparently favorable action of Staphylococcus aureus on chronic diphtheria cases, seems to be, not an antagonism or incompatibility between the two organisms, but an effort to reinforce the favorable, friendly throat flora, in the cases in which they are unable to gain their natural, normal ascendancy."

"Diphtheria" of the Udder of a Cow

Drs. William Robertson and Rory E. McLaren, of the Health Department of Leith, Scotland, report in Public Health (London), January, 1912, a small outbreak of diphtheria suggestive of bovine origin. Nine cases occurred on the route of a milkman and investigation revealed an ulcer on the udder of one of the cows supplying the milk. Scrapings from this udder revealed the presence of organisms which exhibited all the cultural and microscopical characteristics of the Klebs-Loeffler bacillus. Virulence tests were not applied to this organism. There was no evidence of sore throat among the persons handling the milk and swabs taken from their throats were negative. No further cases developed when the milk from the affected cow was no longer used. The authors refer to the fact that Klein has demonstrated that cows inoculated with diphtheria bacilli show subsequent specific eruptions on the udder.

Water Disinfection

The following recommendation for purifying water in small quantities is made by the Health Department of Toronto for the use of campers, prospectors and travelers:

Chloride of lime one level teaspoonful rubbed in four fluid ounces of water and the mixture diluted with twelve ounces of water. Add of the above solution one teaspoonful to two gallons of water to be purified, mixing thoroughly. This mixture gives between four and five parts of free chlorine to a million parts of water, enough to destroy in ten minutes all the typhoid and dysentery producing germs, leaving the water without taste or odor.

Poisoning Epidemic in Berlin

"A mysterious epidemic of poisoning occurred among the inmates of a municipal shelter in Berlin, and having continued for about a week, ended on January 2nd, the number of cases being 171, with 78 deaths. The epidemic was suspected to be due to the consumption of cognac adulterated with methyl alcohol. The cognac supplied by certain public houses near the shelter was analyzed, and when these establishments were closed by the police the epidemic ceased. The wholesale dealer who had supplied the adulterated cognac was discovered, and in his cellars the police found large quantities of methyl alcohol, a portion of which he had sold as genuine ethyl alcohol. He was arrested and will be prosecuted for manslaughter." (Public Health, London, February, 1912.)

Measurement of Air Vitiation

MM. Henriet and Bonyssy, of Paris, have recently proposed to measure the vitiation of air by a direct determination of organic matter therein and which is presumably emanated from the bodies of men or animals. A cold vessel is used to condense the moisture from a known volume of air, after which the water of condensation is examined for oxygen con-

sumed. Results are stated in milligrammes of oxygen required per 100 cubic meters of air. In a series of examinations with this method of the air in parks, workshops, and the like, the analytical results seem to correspond to the objectionableness of the condition encountered.

(Public Health, London, XXV, 5, February, 1912.)

Some English Ideas on Infant Mortality

In the Conference on the Hygiene of Childhood at the recent Congress of the Royal Sanitary Institute (Belfast, 1911) some interesting and suggestive views were expressed on the subject of infant mortality. Sir John Byers, president of the conference, emphasized the national importance of the problem, and drew attention to what he considered the leading influences in causing wastage of infant life. These he believed to be (1) general insanitary conditions and habits in the homes of the poor, and (2) maternal ignorance in the selection, preparation, and administration of food. With respect to Ireland he pointed out that while the infant death-rate for the country in general is low (95 per 1,000 births in 1910), it is still much higher in the urban districts (128) than in the rural ones (74). In Belfast the corresponding figure was 143, and in Dublin 142; as compared with 139 in Liverpool, 132 in Manchester, and 103 in Edinburgh and London.

Proposals to modify Section 61 of the Factory and Workshop Act of 1901 so as to forbid the employment of women until three months after child-birth instead of one month as at present were objected to by Dr. Alfred Greenwood, Medical Officer of Health of Blackburn. In an investigation bearing on this question at Blackburn the subsequent history of 500 births from five districts representing varying degrees of prosperity were thoroughly studied. Among 314 of the mothers industrially employed 13.5% of the infants died in the first year. Among the infants of the remaining 175 mothers not industrially employed the corresponding mortality was 12.2%. Arguing from the insignificance of this difference in the face of greater poverty among the industrially employed, and from the fact that an increasing number of mothers are coming to take the longer period voluntarily, Dr. Greenwood believed that to increase the legal period would be of doubtful advantage. On the other hand such a course might have disastrous results in cases of extreme poverty.

The satisfactory operation of the Notification of Births Act was the subject of a paper by Dr. W. G. Willoughby, Medical Officer of Health of Eastbourne. Upon receipt of a notification a visiting nurse is sent to confer with the mother, unless the doctor in charge advises to the contrary. The nurse makes such suggestions, in a tactful manner, as seem called for, revisits the case, and takes a permanent interest in its progress. In 1910 34% of all the births in the district were visited in this way, the remainder being among the well-to-do, institutional births, and those excepted by the medical men. The results seem to have been most satisfactory. In the visited cases, in spite of their being among the poorest people, the mortality was but 57 per 1,000 births, as compared with 93 for the whole district, and 109 for the cases too well-to-do to be visited. Among the illegitimate births the mortality in visited cases was but one-tenth as compared with one-quarter among the unvisited. Although the figures involved are somewhat small for a statistical basis (the population of Eastbourne being 53,000), these results are extremely suggestive, and should be encouraging to those who are working for similar measures in this country.

(Jour. Royal San. Inst., XXXII, 12, Jan., 1912.)

The Value and Efficiency of Fumigation

To fumigate or not to fumigate that is the question which is one of the most important for health officials to solve at the present time. There is much dissension as to the value of terminal disinfection after the vacation of premises which have been occupied by patients who have had the common infectious diseases. A strong argument against the practice has recently been made by Dr. Wm. W. Walcott, State Inspector of Health of Massachusetts.* Dr. Walcott made a series of experiments with formaldehyde which was generated in the following ways: Generator, permanganate of potash, aluminum sulphate, calcium chloride and certain proprietary forms of so-called "solid formaldehyde." The tests were made under conditions similar to those used after a case of disease, and "in the manner in which the average disinfector does his work." The test rooms were prepared in a

proper manner by closing up all openings with adhesive paper strips with the exception of the key hole and cracks around the door, which were stuffed with absorbent cotton. The test organisms were B. diphtheriæ, Streptococci and Staphylococci which were obtained from diphtheria and scarlet fever patients. The method of obtaining the cultures was as follows: "Swabs were taken, and blood serum tubes, inoculated from the swabs, were incubated for twenty-four hours. At the end of that time, sterile cloths inoculated from the cultures were placed at different levels in the rooms or smears placed on the walls or floor, and exposed to the disinfectant for twenty-four hours. At the end of that time the rooms were opened and blood serum tubes inoculated from the test cultures.

"The inoculations were made by moistening sterile swabs in sterile water and rubbing them over the test cultures. The tubes were then incubated for twenty-four hours, at the end of which time slides were examined and the growths checked against those of the original cultures. If no growth was found at the end of twenty-four hours the incubation was continued for forty-eight hours, and, if necessary, for seventy-two hours. If no growth was found at the end of that time, the culture was considered sterile."

The following interesting statements are made as a result of the experiments:

"As regards the amount of disinfectant used, it seems evident that amounts of formalin ranging from 12 to 32 ounces to 1,057 cubic feet of air space have no consistent effect upon organisms exposed to its influence for twenty-four hours, and that the results are as varying when the two chief methods of releasing the gas are compared. The results obtained by using the permanganate method show slightly more negative findings, but in experiment No. 9, which shows the best results, the cultures were all old. When fresh cultures were used the results were no more consistent than by the other method.

"The proprictary preparations, when used in the amounts specified in the directions, for the contained air space, persistently and consistently refused to give results. In two instances, where double the advertised amounts were used, there was 50 per cent. of success, but in other instances the same failure resulted."

Dr. Walcott also collected data as to the methods of disinfection used in the towns and cities of his district as well as from a number of cities in the United States and concludes his interesting contribution as follows:

"Since the results of experiments in dealing with known quantities in a room of known size under actual service conditions lead us to doubt the value of fumigation as it is carried out today, it seems only fair, when we consider also how the work is done in the local communities, to conclude that fumigation as actually practiced is a waste of time and money, and, furthermore, that it gives to the public a false sense of security.

"While it is true that fumigation is the indirect means of causing a sick room to be thoroughly aired, it seems that even good ventilation of a room cannot justify the general practice of 'fumigating' suspected bedding and such articles of the infected as could, and should, be boiled.

"The laity also has such strong faith in the efficiency of the present methods of fumigation that scrubbing and subsequent cleansing of the room and its contents are considered by them unnecessary, and so frequently not done.

"It would seem best, therefore, to substitute for the present day 'fumigation' such precautions as thorough airing of the room, cleansing by scrubbing, and possibly renovating, and the destruction by fire of such articles as might act as media on infection —articles that cannot be properly cleansed or exposed to sunlight."

No reference is made with regard to the temperature or humidity conditions that existed at the times when the experiments were carried on.

*Annual Report, State Inspectors of Health of Massachusetts, 1910., pp. 108-120.

Influence of Heat on Infantile Mortality

"A recent issue of the Deutsche Vierteljahresschrift fur offentliche Gesundheitspflege vol. 43, parts 2 and 3) contains an interesting paper by H. Leifmann (Privatdozent der Hygiene) and Dr. Alfred Lindemann. In this paper the authors discuss very fully the causes of infantile mortality in relation to the heat of summer in Berlin and some other large towns such as New York and Munich. The paper deserves some special notice, since the authors have been at great

pains to tabulate the daily mortality of infants for several years, together with a daily thermometric record taken at 2 p. m., with a maximal temperature. Reasons are given for preferring the 2 p. m. temperature in endeavoring to find a correlation between it and the mortality.

On looking over these one cannot help being struck with the remarkable parallelism of the two curves, and it is difficult to avoid the conclusion at which the authors arrive, that there must be some very close connection between heat and mortality. The two main views are represented by two schools, in one of which—represented by Meivert—a direct effect is attributed to heat, and in the other an indirect effect through the heat causing decomposition of food, and as a consequence infection through the alimentary canal. The authors incline to the former view, and state that the parallelism is most striking in the early summer, and they are led to the conclusion that the heat must constitute an immediate source of danger to infants, and that it does not require decomposition of milk by heat, or the spread of infection to increase the mortality among infants. Their reasons for this view are as follows:

1. In almost every year one finds a striking parallelism on hot days between the temperature and the infantile mortality in early summer.

2. Only temperatures of over 23° C. are connected with a distinct rise of the mortality.

3. Years of abnormal conditions of temperature show a like abnormal behavior of the mortality.

4. The mortality of breast-fed children is increased.

5. Infants which live in underground rooms and frequently, owing to the high temperature outside, receive milk decomposed during transport, do not show increased mortality.

6. The mortality rises often so quickly with the temperature that an immediate injury to the children must have taken place. If death occurs one or two days after the beginning of the heat, it must be considered that (a) the illness began at the time of the greatest heat; (b) that the injurious agent is the heat of the dwelling, which follows after and remains longer than the temperature of the outer air.

7. On hot days of the early summer the children do not die mainly of gastro-intestinal complaints. Convulsions come first. These symptoms are similar to those that one finds in adults on over-heating, viz., heat convulsions.

8. The mortality follows a falling temperature remarkably quickly. This cannot be explained either by infection or decomposition of food.

The conclusions are confirmed by clinical observations (detailed in the paper).

The recommendations for the prevention of the mortality deal with the (1) early summer and (2) the later summer, and question of (a) the removal of infants into cooler quarters, (b) the keeping of the dwelling cool, (c) quenching thirst, (d) clothing, etc., are all fully discussed. The paper is well worth studying by those interested in infantile mortality."

Public Health (London), January, 1912.

North Carolina and Tuberculosis

The Bulletin of the North Carolina State Board of Health for the current month gives up the greater portion of its space to the consideration of tuberculosis. The article includes about a dozen pages of text and a number of illustrations. It considers geographical distribution, some comparisons with diseases much less fatal but feared through being less familiar, and passes next to the consideration of the cause, the seed and the soil. The latter depends on the condition of the body and this can be controlled to an extent by outside influences. The article considers the importance of sunlight, of ventilation and of good food and the dangers of worry and alcohol. Another article in the Bulletin, by Dr. Hubert A. Royster, calls attention to the fact that the public health is made up of the sum of the health of the individuals. Health problems, therefore, are to be settled, not in the herd, but singly. "Some are born sick," writes Dr. Royster, "some achieve sickness and some have sickness thrust upon them," and the way to avoid it is by getting out of its reach or by throwing it off when it comes. With reference to education, this writer says, "In the last analysis we want to get hold of the average man, the most uninformed man, and tell him how to live right. Laws are good and we must have them, but there are some things that cannot be legislated into the peo-

ple." An article on "Constipation" calls attention to the importance of the inconspicuous, another discusses the necessity of interesting the women in health matters, while an editorial notes that the county health officer is now the weak link in the chain. The Bulletin is worthy the attention of health officers and those interested in the splendid work that the South is doing with its modern health movements. It is under the care of Dr. W. S. Rankin, who not long ago made the tour of the Northern States seeking the best and most efficient methods.

Milk Preservatives

The following taken from the Medical Officer (London), February, 1912, should be of interest to the chemists of State and local Boards of Health who have to analyze milk and cream samples for preservatives:

"There is a great trade done in so-called milk preservatives, most of which contain formalin, boracic acid, salicylic acid, or similar substances, which are not difficult for an analyst to discover. According to a report to the Local Government Board (England and Wales) of Dr. G. W. Monier-Williams just issued, a method has been discovered of treating formaldehyde with sodium nitrite in such a manner that the detection of the former is not easy, unless the chemist is alive to the possibility of the presence of sodium nitrite.

"Dr. Monier-Williams states that a quart of milk treated with the preservative will contain two grains of sodium nitrite, which is the maximum pharmacopœal dose of that substance. He adds that sodium nitrite is a dangerous drug, with a powerful action on the heart, and should not be taken except under medical supervision. Apart from the possibly injurious action of the formaldehyde, it is clear that the consumption of milk containing the maximum medicinal dose of sodium nitrite in one quart is fraught with considerable danger to health, which would be accentuated in the case of children or invalids."

Rain-Water and Milk

A novel defence was recently brought in by a milkman in Wigton, England, who was charged with having added over 10 per cent. water to the milk he sold. He stated that it was due to the fact that he left the milk can outside all night and that there had been a heavy rain which accounted for the added water. It was demonstrated in court that at least 12 inches of rain would have had to fall during the night in order to have caused the amount of water in question to have entered the can. This would represent one-third of the annual rainfall of Wigton. The milkman was fined $20.

Pellagra

Pellagra has been the subject of a recent epidemiological study in the vicinities of Spartanburg, Chester and Rockhill, South Carolina, under the direction of R. M. Grimm, Assistant Surgeon, Public Health and Marine Hospital Service.* Data was collected in 380 cases, and 83 cases were personally visited to collect data bearing on the disease.

In this preliminary report, facts and observations relating to the epidemiology of the disease have been recorded, with no further attempt at discussion and analysis of the same, and the main points are as follows:

The towns investigated are located more than 500 feet above sea level and are usually well looked after by the mill operators. The majority of cases personally visited were cotton mill workers, poor, overworked and underfed. Their homes showed signs of poverty and neglect, specimens of the ordinary bed-bug being taken from several. The majority of the houses of the pellagrins were unscreened, and mosquitoes were prevalent. Packed meats and canned goods form a large proportion of the daily diet, bought both at the mill and other local stores. All of the pellagrins seen by Dr. Grimm (83 cases) gave a history of having eaten corn products more or less regularly as an article of diet.

The study of a small cotton-mill village in Chester County was of particular interest. This village, with a population of about 500, has had 25 known cases of pellagra develop in it.

The comments and discussion of the cases, which will doubtless be published later on, will be waited with interest combined with the hope that something may be discovered which will lead to an understanding of the causation of this obscure disease.

* Public Health Reports. Vol. XXVII, No. 8.